MODEL AIRPLANE NEWS

6-INCH R/C **SPY PLANE!** page 130

THE WORLD'S PREMIER R/C MODELING MAGAZINE

48120

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ON THE COVER: Kent Nogy's BVM Bandit comes in for a landing at the Arizona Jet Rally. Insets: top—Hobby Lobby's Vari-Eze canard for electric power; bottom—designed by Pat Tritle, this scale Shoestring racer is easy to build and is powered by a 6V Speed 400 motor. See the construction article on page 62.

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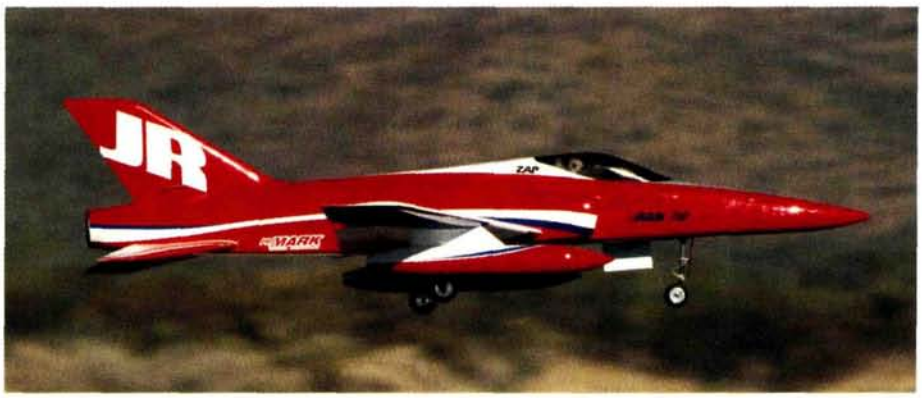
The Magic of Flight

WHEN I WAS A KID, airplanes were magical things to me. I had a Hubley, Matchbox and Dinky air force and was a master at making airplane noises ... or so I believed at the time. I remember sitting with my dad at the end of the runway for hours, watching the airplanes taking off and landing. Could we identify the plane? Could we see the pilot? Would he see us wave? I suppose it was a bonding experience bet-ween my dad and me as much as anything else, but there was another kind of bonding going on, and my love affair with airplanes continues to this day. I fear that the sterile nature of airports and the general sameness of the airplanes flying into and out of them today may deprive future generations of these same pleasures.



The 10th Annual Arizona Jet Rally was a big success. Hope you enjoy the coverage of one of the West's best.

I assume that deep down somewhere, it is this love for airplanes that causes me to still be so in awe of anything that flies. Though I've observed flight countless times, each time I see an airplane fly, it seems to defy the possible. I know; I've read all the stuff about how lift is generated by the creation of differential pressure on the top and bottom of lifting surfaces, and all the rest of the stuff that attempts to "science-ify" the process of flight. I know it's possible; that it's not magic. But it still thrills me to no end to see flight occur. There are a lot of modelers like me in this regard—maybe most of them—and each has stories to tell about how he got hooked on airplanes.

And my goodness, how the thrill factor increases when it's an airplane crafted with your own hands. It doesn't matter whether I've just let loose of a pennyplane or a big, gas-guzzling warbird, the feeling is electric. Interestingly, I feel closer to the action somehow with my small, free-flight planes. Maybe it's because you have to trim not only the flight characteristics but also the directionality of free-flight models, so there's something very special about seeing your masterpiece cruising overhead in well-mannered circles. Then again, pointing an R/C plane down the runway provides the thrill of controlling its exit from earth (and, if you're lucky, its return), directing its trajectory to suit your whim. I'm sure you've felt it—that feeling of doing the first loop, first roll, or maybe the first time you bring it down on the deck for a low pass. It just grabs you in the gut, and you know why you build model airplanes.

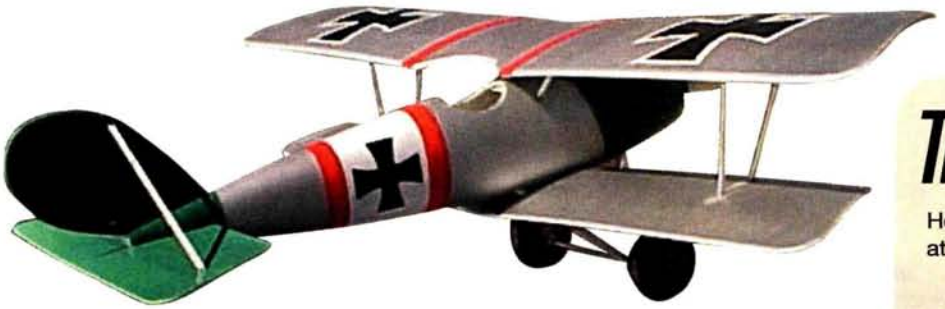
It's said that "bigger flies better," and I suppose that's true. But I've never seen any of the different types and sizes of models to be better or worse than any other. There is no "best" model for me. When I look at all the types of models available, I see opportunity to experience different flight envelopes, not an imaginary scale on which I'm supposed to rank models from best to worst. When I'm handed a slow, low-powered plane, I don't wish for aerobatic potential; I start thinking about how smoothly the plane might do touch-and-go's, or I might see how symmetrically I can fly a horizontal eight with it. When I fly a large warbird, I don't think about doing avalanches; I think about flying it like its full-size counterpart. Then again, I do enjoy flying aerobatics as much as anyone, so I do like to get my hands on a CAP or Extra once in a while. And when the wind is down and I want to be truly amazed by flight, I'll launch one of my small, free-flight planes and simply watch ... getting the full enjoyment from this thing we call flight.

JETS AND FLYING POTENTIAL

This issue demonstrates some of the flying variety that we enjoy today. In it, Gerry Yarrish talks about flying large airplanes in a scale fashion, touching on one reason that big planes seem to fly better. Dave Garwood takes a look at the renewed interest in flying simple, wooden sailplanes; there's something of a renaissance of interest in these aircraft. Roy Clough has been doing some investigation of the use of Plexiglas interplane "struts" to improve knife-edge performance of his sport biplanes, and he shows you how to make your own. We're also starting what we hope will be a series of articles by Dan Wolanski on flying IMAC aerobatics. This month, Dan discusses the shark's tooth maneuver and its variants.

I had the opportunity to attend the 10th anniversary of the Arizona Jet Rally, and it was great. With 114 pilots and a whole bunch of turbines, the guys had a lot of fun. Turbines have definitely moved into mainstream model aviation. Starting procedures have become simple, reliable and very safe. Some of the best jet pilots were in attendance, and they showed off their stuff and provided some really good photo opportunities. I hope you enjoy what I've managed to pack into our six-page coverage of the event. I left out all the photos I took of tail cones moving too fast.

THE FIRST BIPLANE SLOWFLYER!



HOBBY LOBBY **Pfalz**

Hobby Lobby's Slowflyer series has been changing the face of R/C, and now they've added this great-looking WW I bipe from Simprop. Like the rest of the Slowflyer series, this 36-inch-wingspan, stand-off-scale rendition of the 1917 German biplane fighter is very easy to assemble (about 5 hours of building time) and is constructed of high-quality, prefabricated and prepainted foam components and precision die-cut wood parts. Pfalz (pronounced "fawlts") is a true Slowflyer and can, according to Hobby Lobby, be flown right in front of your face at incredibly low speeds, yet as a biplane, it's astoundingly maneuverable. This is because the Pfalz has a flying weight of only about 11 ounces and a huge wing area of 341 square inches. That, my friends, translates into a wing loading of 4.3 ounces/square foot! Need I say more?

Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.

TruSpeed—No Lies

How many times have you heard this one at the flying field:

"My Cherokee does 80mph, easy."

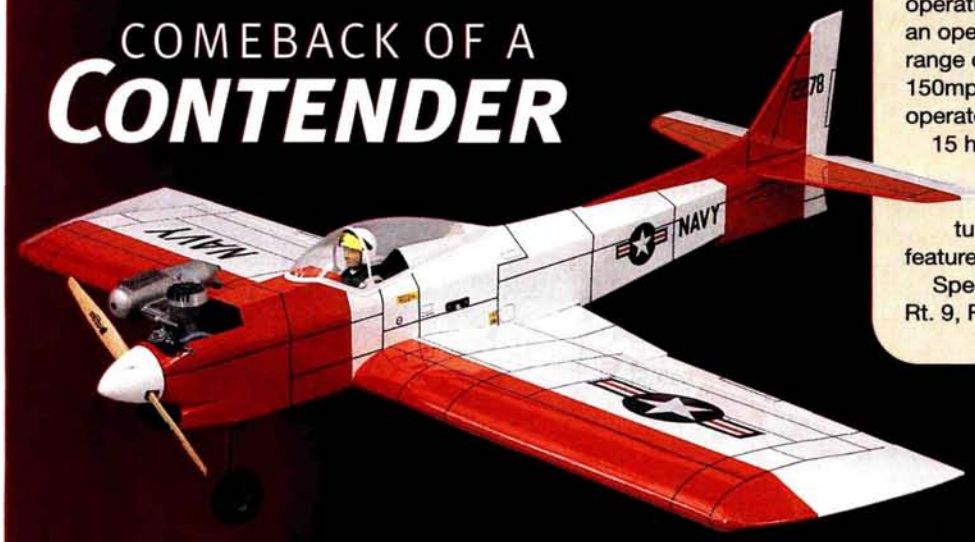
"Oh, yeah? My Cub does 100mph in level flight!"

Well, the affordable TruSpeed radar gun is here to make honest men of all of us. It can be mounted on a camera tripod to serve as club referee in speed disputes and/or impromptu contests.

TruSpeed's accuracy is better than ± 0.5mph, and it has three, easy-to-use operating modes, 10-speed memory and an operational range of 0 to 150mph. TruSpeed operates for up to 15 hours on two 9V batteries and has a tuning-fork accuracy-verification feature.

Speed Products Inc., Ste. 402, 3587 Rt. 9, Freehold, NJ 07728; (732) 761-2525.

COMEBACK OF A CONTENDER



The Contender was my very first low-wing model. With its fat, Ugly Stik-type airfoil, it was the perfect choice, and it was a lot better looking than an Ugly Stik—in my humble opinion, of course. I bought it well-used for $35 (remember, this was 1972) from Nick Olivett, father of my "Piston Power" associate and good buddy, Vic Olivett. I had more fun with it than with probably any model since. My protracted low-wing learning curve ate its way through three Contenders in all. To say I'm very pleased it's back with us is an understatement; to see it return for its 30th anniversary in Gold Edition form is truly a joy. The Contender's all-wood structure can be framed out in only a few nights. With the Gold Edition treatment, building has become even more streamlined; very little carving or shaping is required. Since it's a Gold Edition kit, it features CAD-designed parts with interlocking construction. Unlike the old Contender, the new version features dual-servo aileron control for computer-radio applications. In the old days, we were just glad to have radios that worked 60 percent of the time! Specs: wingspan—53.25 inches; wing area—660 square inches; weight—6 to 6.5 pounds; engine requirements—.40 to .61 2-stroke, or .52 to .70 4-stroke.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL; (217) 398-6300; fax (217) 398-0008.

A LITTLE EXTRA TAIL

Since its release in 1994, the Midwest Extra 300S has earned a reputation as a high-quality, easy-to-build, great-flying aerobatic model. Now, for 1999, Midwest has refined the design even further. The new version—the Extra 300XS—features an entirely new tail group that includes more rudder area, airfoil-shaped tail surfaces and counterbalanced elevators. A Success Series kit, the 300XS features a fully illustrated 3D CAD, step-by-step construction manual, full-size plans and Micro-Cut Quality Wood parts. Specs: wingspan—80 inches; wing area—1,162 square inches; flying weight—14 to 17 pounds; engine requirements—1.8 to 2.2 2-stroke, 2.7 to 3.0 4-stroke, or 2.2 to 2.8 gas ignition; radio required—4-channel with five servos.

Midwest Products Co. Inc., 400 S. Indiana St., P.O. Box 564, Hobart, IN 46342.

ROSE-COLORED GLASSES

Always pushing eyewear development to its highest degree, Zurich Intl. has come out with a unique concept. Zurich's new, rose-colored sunglasses are intended for the lower light levels produced by steely, high-overcast days with highly defused sunlight. Normal dark-colored glasses shield your eyes from excess light, but Zurich's rose-colored glasses intensify color and contrast, and this makes model flight-attitude and -orientation easier to evaluate. Zurich's sunglasses also shield against harmful UV rays and are made of a ballistic-grade polycarbonate plastic so they're able to serve as excellent safety glasses. Who says it's not good to view the world through rose-colored glasses?

Zurich Intl., 3650 Keefer Rd., Chino, CA 95973; (800) 533-5665; fax (530) 893-9575.

GEM 2000

ELECTRONIC GUARDIAN

The Gem 2000 is a full-time, automated, onboard electronics troubleshooter. If, during the preflight check, the onboard equipment—loaded battery-pack, receiver, switch harness or servos—has a problem, the GEM 2000 will detect it and give the alert. A single "laser bright" LED gives the "go" or "no go" decision. According to the manufacturer, the 3-stage LED can easily be seen in flight in full sunlight. Its features include plug-and-go installation; surface-mount-technology microprocessor; vibration-, weather- and fuel-resistant construction; 25 percent preset safety margin; and adjustable 4 to 10V operation range. Available with a standard CB-mounted or remote LED, its introductory price is less than $25.

Electroteck, 14667 Lafayette Cir., Magalia, CA 95954; (888) 567-2862.

It's big, it's built, and it's a

Pitts

This beautiful, all-time-favorite Pitts S2B is manufactured by Signature Series, designed by renowned aerobatic pilot/designer Dave Patrick and brought to us by Cermark. I would like to thank everyone involved because it's not only one of my all-time favorites, but it's also in my all-time favorite size: that is, the .90 2-stroke, 1.20 4-stroke. Big enough to fly great; small enough to fit in the car! According to Cermark, "The Pitts is like no other ARF on the market, period! It is precision-crafted in wood and painstakingly covered with Ultracote. These are not mass-produced models." All fiberglass parts are hand-painted, and the hardware package includes such niceties as pull-pull control linkages. Specs: wingspan—60 inches; wing area—1,020 square inches; flying weight—9.5 to 10.5 pounds; engine requirements—.90 2-stroke, or 1.20 4-stroke; radio required—4-channel with five servos.

Cermark Co. Inc., P.O. Box 2406, Fullerton, CA 92833; (714) 680-5888 or 5889; fax (714) 680-5880.

AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," MODEL AIRPLANE NEWS, 100 East Ridge, Ridgefield, CT 06877-4606 USA; email man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

SOCIAL SIDE OF MODELING

I read your Editorial in the March '99 issue, and it hit the nail on the head. I used to fly during the day by myself, which is great if you want a lot of stick time. But it is more fun to sit around and talk to the rest of the guys about what they are doing or have done, and then fly a little, too.

Do me a favor; let George Leu know you heard from me. We had several phone conversations a few years ago about ducted fans. I'm from Houston, TX. I'm flying a DCM ⅕-scale P-39c, a Byron P-51 and a Kyosho electric T-33. I have an old Miller T-38 and a JMP F-4 under construction. [email]

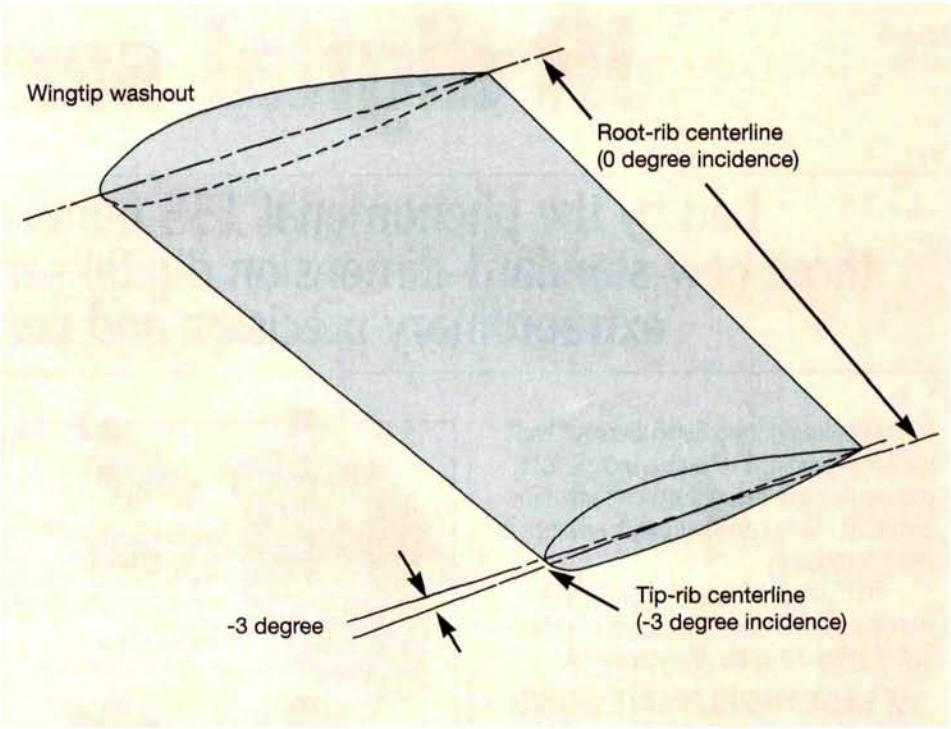
GARY BAKER

I'm glad you liked my Editorial on the social sides of our hobby. Rather than letting George know you wrote, I've put your letter here in "Airwaves" so everyone will know. Do you park that Kyosho T-33 under the wing of your P-51? LM

TIP STALLS AND RECEIVER PACKS

I have two questions for you: 1. What is a tip stall? 2. With an electric-powered plane, do I need to have a separate battery pack for the receiver and servos, or can they be powered off the battery cells for the motor? My system is the Futaba 6XA. [email]

BRUCE SACKS



Tip stall is when the tip of the wing stalls before the more inboard areas of the wing do. The result is that the stalled wingtip falls, and the plane will follow it. A typical solution to the problem is to add washout to the wing. This produces a situation where, for any aircraft angle of attack, the wing will have a higher angle of attack inboard than outboard, forcing the stall inward. Another solution is to use a slightly thicker airfoil on the outer panel than on the inner.

Your question about receiver packs in electric airplanes is a bit more complex, as the answer is "either way." Whether you need a separate receiver pack depends on whether your speed controller has a battery eliminator circuit (BEC). Most controllers designed for seven or fewer cells will have such a circuit, and you can run your radio gear off the power system's battery. If your controller does not have one, you'll need a separate receiver pack. LM

DOESN'T LIKE FLAT SIDES

I recently subscribed to *Model Airplane News* and, as a new modeler, I enjoy very much reading its great ideas. I was dismayed with the picture of the P-38 on the front cover of the March '99 issue. At first look, I said, "There's something wrong with that model!" Then, on closer examination, I could see that the sides are flattened and straight. I have eight pictures posted in my office and none have straight sides; they are all rounded!

You see, I have the pictures of the real planes, as I am building one for myself. I'm disappointed that you would publish such a model. I'm sure that the building technique and finishing is great work, but this does not shine as an example of a model of a P-38. [email]

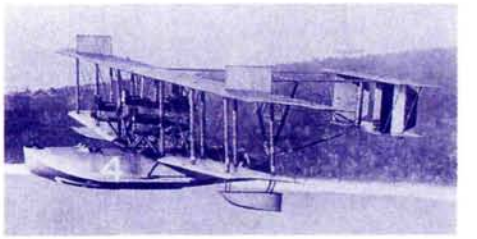
KING BARNES

You're right, King, the P-38 on our March cover does have flattened sides. And while it may not "shine" as an exact scale depiction of a P-38, Dave Garwood's photo of it certainly shines, and that's why we used it.

As for using somewhat flattened sides in the development of sport-scale warbirds, there is a long-standing tradition of doing just that within our hobby. While we love precision scale, it doesn't cause us to look away from good sport-scale designs. We must not be alone in that because many of the big name scale designers have designed some very popular sport-scale designs, emphasizing the ease of building over exact outlines. Rich Uravitch's OV-10 (plans available from our plans service) comes immediately to mind, as it is one of our most popular plans, looks very much like an OV-10 and yet it is much easier to build with its flattened sides. Nick Ziroli, designer of the most popular designs we see in the upper crust of scale competition today, is now producing a series of designs for profile warbirds. These models aren't designed with the notion of exact scale, but they sure do build quickly and are a lot of fun to fly.

The bottom line is that there are all sorts of ways to enjoy this hobby. Do what you want; we'll try to cover it all. LM

AIR WAVES



NEEDS INFORMATION FOR NC-4 RESTORATION

I am the director of the First Across Organization, an organization devoted to the replication of the U.S. Navy's NC-4 and its flight across the Atlantic in 1919 in time for the 90th anniversary in 2009. For more information, see our website at www.firstacross.hypermart.net /nc4home.htm.

I have a request, and that is to find out where Willis Nye got the plans for the NC-4 hull from which to scale his drawings of the lines. On sheet 2 of the plans drawn for *Model Airplane News*, he says the hull profiles were "... scaled from the plans of the hull." If Mr. Nye is still alive, or if you have them in your files, I would be very interested in obtaining copies of the original drawings.

JOHN BAYER
Kirkland, WA

I'm sorry to say that we don't have any of Mr. Nye's working drawings, but maybe one of our readers can help you. Anyone who has information on the NC-4 can either email John at jbayer@juno.com, or write to the First Across Organization, c/o John Bayer, 12036 100th Ave., N.E., #E102, Kirkland, WA 98034-3832.
LM

PLANES WORTH MODELING

I appreciate the 3-views you provide in *Model Airplane News* but must fault you for not including the color schemes. Debra Sharp provided a captivating drawing of the I-11 Peque in the March issue. I wonder if she could be called upon to provide the scheme (what are the Spanish insignia?), since this looks like an excellently proportioned model. [email]

EDWARD ZAPOLSKI

Glad you enjoy the 3-views, Edward. I particularly liked the Peque but, unfortunately, I couldn't find any information other than what I presented in the magazine. The black-and-white photos and 3-view came from the Model Airplane News *archives, and there was no mention of color scheme. I do think it's "worth modeling," though, and I hope you have more time than I to find the additional scale documentation. If not, it would make a darn cute sport-scale model!*

If you do model it, please send a photo and letter to "Pilot Projects," c/o Model Airplane News. *I'd love to publish it.* DS

PILOT PROJECTS

A look at what our readers are doing

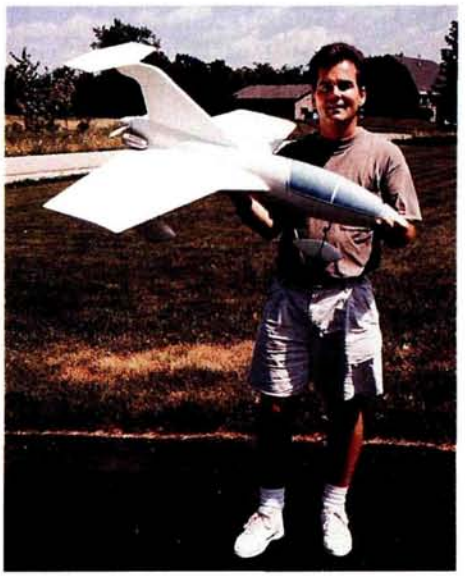
SEND IN YOUR SNAPSHOTS. ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

GUNG HO

Pete Alstrup of Smedjebacken, Sweden, spent four years building this 105-inch-span, 26-pound model and outfitted it with two SuperTigre .90 engines, Dave Platt retractable landing gear, Vailly Aviation wheels and Robart gear struts. Gung Ho is covered in Skinny Dip and has scribed panel lines, handmade nose art and graphics, functional gear doors, landing lights and cockpit details. Pete writes, "Flying Gung Ho for the first time was a very thrilling experience! One engine quit, and I had to make it back to the field for a belly landing."



PUSHER PLANE

Sean Smits of Green Bay, WI, writes that this original design is the result of eight years of experimentation. The model has a fiberglass fuselage and is powered by a .46 Magnum helicopter engine turning an 11x7 pusher propeller. The elevator is driven by several internal bellcranks, and Sean says that the model's flight characteristics are excellent.

MEMPHIS BELLE

Tom Sparkes' B-17 has a 9-foot wingspan and weighs 20 pounds, and it's powered by four AstroFlight 15 geared motors on 32 cells. Tom writes to us from Australia, "It has loads of power, climbs out very strongly and is a real pussycat to fly. The four motors give it 10 pounds of thrust, and it cruises nicely on ½ throttle."

'29 DAVIS D1-K

Bob Wilson of Franklin, NC, built this ¼-scale, 90-inch-span model from DGA Designs plans and covered it with Stits fabric with simulated rib lacing and pinked finishing tape. A 5-cylinder Saito 325R engine swinging a 20x8 prop replicates the 5-cylinder Kinner that was in the original, and Bob made the model's removable cowl out of .012-inch-thick aluminum litho plate.

FLOATIN' AROUND

This 1/6-scale, 116-inch-span Fairchild Super 71 features all-wood construction and was built by Bruce Harlow of Ellensburg, WA, from Sea-Clusion Aeronautics plans drawn by Gene Falada. The Super 71 is dressed in Super Shrink Coverite and Krylon paint and has fiberglass-covered floats. A Zenoah G-62 gets the 31-pound model off the water.

'30s RACER

Marcus and Michael Lang and their father, all of Graz, Austria, designed and built this Wittman D12 Bonzo using only two old photos as documentation. Their racer has a 66-inch wingspan, weighs 13 pounds and is powered by an electric motor with a 1:2 gearbox and 28 cells. The Langs note, "It offers an interesting view in the air, unequal to most of the other models, and it is great fun, if not too easy, to control."

PRETTY PANTHER

Kenneth Fiala of St. George, UT, built this all-balsa F9F Panther using Nick Ziroli plans and accessories, such as the ABS tip tanks. The 72-inch-span, 16-pound model is powered by an O.S. .91 DF engine and a Ramtec fan, and it uses Century Products landing gear. Kenneth writes, "For the size and weight of this plane, it flies pretty fast and does all the maneuvers of a ducted-fan jet."

LOENING AMPHIBIAN

This 1/5-scale, 9-foot-span model is the handiwork of Fred Tuxworth, who built it using Smithsonian drawings. The 38-pound, fiberglass-covered plane is made mostly out of foam with spruce spars and balsa capstrips, and it has homemade landing gear and functional rigging rods made out of .035 stainless-steel sheet. Fred writes, "I have been building models off and on since 1927. This model was the 'postgraduate' course and required more skills than I had bargained for. I have never had more fun in my life." Fred hails from Mattapoisett, MA.

LITTLE RED WAGON

Warner Lowe of Lake Oswego, OR, sent this photo of his Kyosho Agwagon, which he converted to electric power. An Aveox 1409-2Y motor with an AstroFlight Super Gearbox on 15, 1700 or 2000mAh SR cells spins a 13x8 Master Airscrew propeller to create a static thrust of 4 pounds at 36 amps. The model weighs 7¼ pounds. Warner writes, "It has a lot of performance and jumps into the air on takeoff."

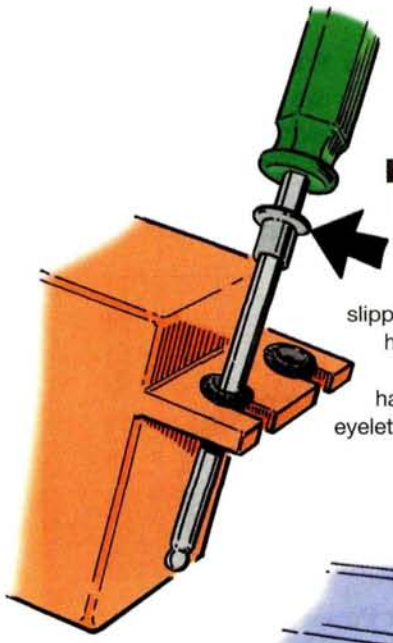
SMALL BUT MIGHTY

Andrew Gholic of Ontario, Canada, recently converted this AstroFlight Viking from electric to CO_2 power. He writes, "Sluggish on a single-cylinder .049 Davis conversion, so I designed an alternative 'firing' opposed twin. It now climbs with authority! It swings a 12x8 prop—not bad for an engine less than .10ci displacement!" The model is covered in MonoKote and 21st Century fabric and uses a 2-channel radio for control.

HINTS & KINKS

BY JIM NEWMAN

SEND IN YOUR IDEAS. Model Airplane News will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



EYELET INSERT

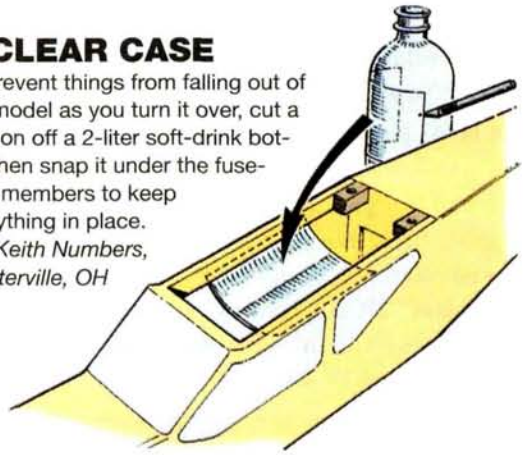
Easily insert metal eyelets into your servo's rubber grommets by threading each onto a 5/64-inch (2mm) ball-end Allen wrench, slipping the wrench into the grommet hole, then pushing the eyelet into place by pressing down on the handle. A tiny dab of soap on the eyelet helps, too.

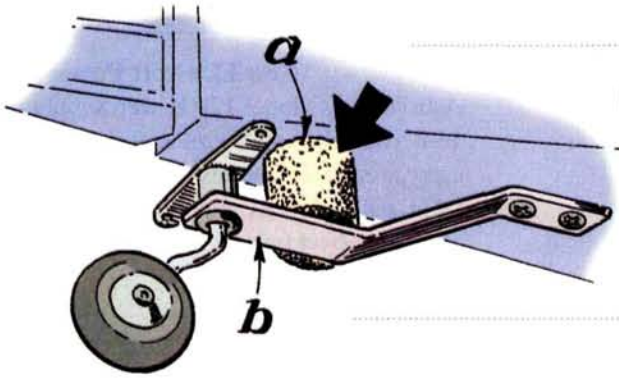
George Brucker, Schenectady, NY

A CLEAR CASE

To prevent things from falling out of the model as you turn it over, cut a section off a 2-liter soft-drink bottle, then snap it under the fuselage members to keep everything in place.

Keith Numbers, Centerville, OH





NOW HEAR THIS

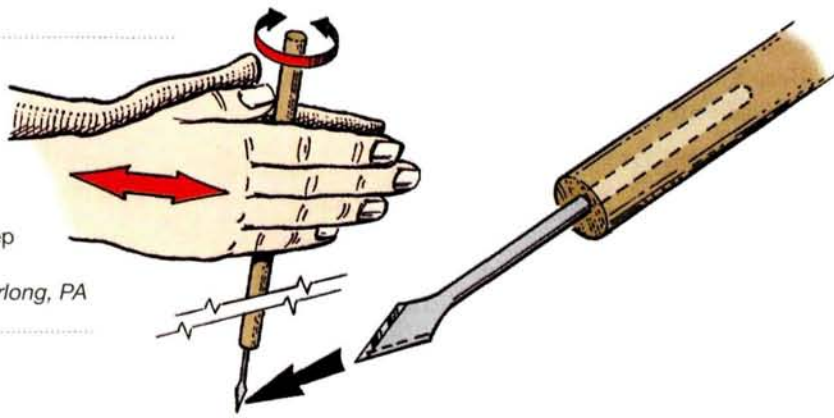
Take the bounce out of your tailwheel spring with a foam earplug (a). Glued between the leaf spring (b) and the fuselage bottom, it absorbs the shock but returns slowly to its uncompressed state, just like a car's shock absorber.

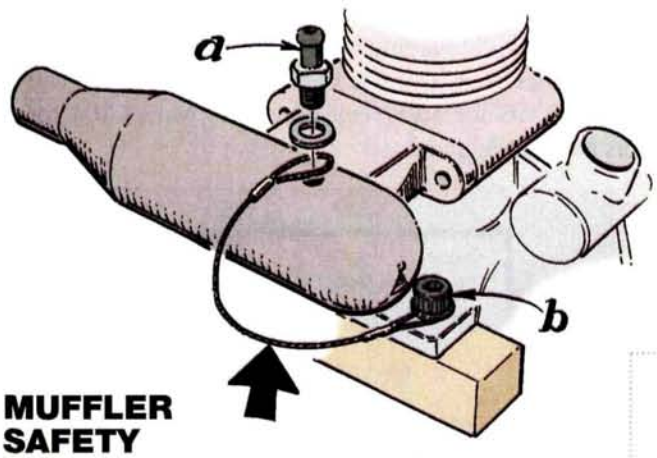
Frank Black, Pascagoula, MS

DO THE TWIST

Rick saw Vietnamese craftsmen use these simple small drills, rolling the dowel back and forth between their palms. Make drills by hammering music wire flat, then grind cutting edges on it before gluing it into 1/4-inch (6mm) dowel. These are ideal for drilling holes deep down in a fuselage.

Rick Brown, Purlong, PA

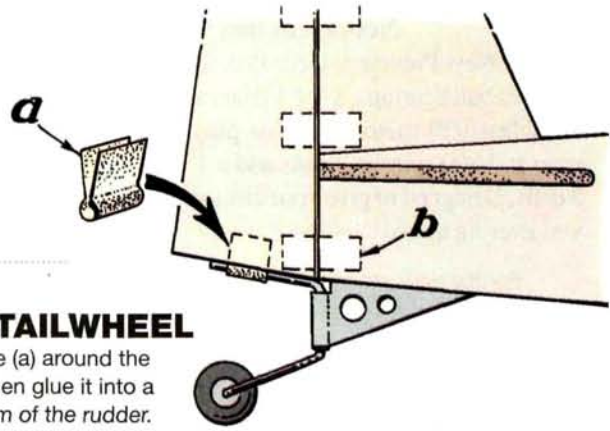




MUFFLER SAFETY

Avoid muffler loss with a steel fishing cable trapped under the pressure tap (a) and under a mounting screw (b). The swivel that comes with the leader can be discarded.

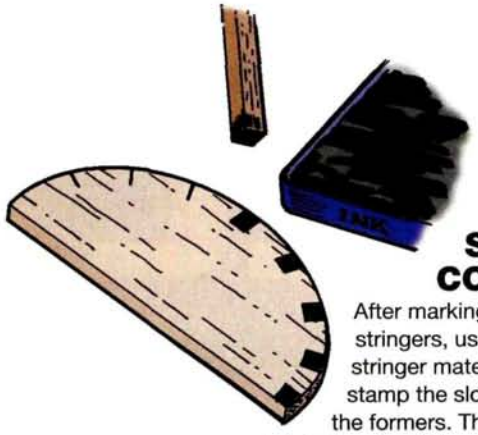
B. Yorke, Niagara Falls, Canada



SECURE TAILWHEEL

Wrap a CA hinge (a) around the tailwheel arm, then glue it into a slot in the bottom of the rudder. This provides a secure installation, and the hinge can be installed at the very bottom of the rudder (b).

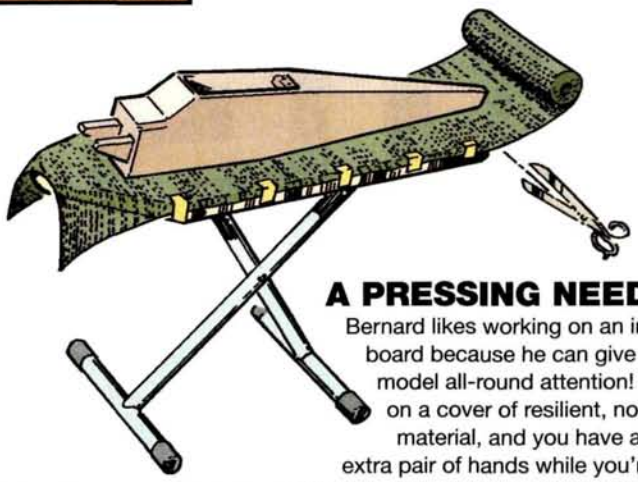
Ron Brooks, Port Charlotte, FL



STAMP COLLECTOR

After marking the position of the stringers, use a piece of the stringer material and an ink pad to stamp the slots on the edges of the formers. Then use a very sharp blade to cut out the close-fitting slots.

Robert Johnson, Philadelphia, PA



A PRESSING NEED

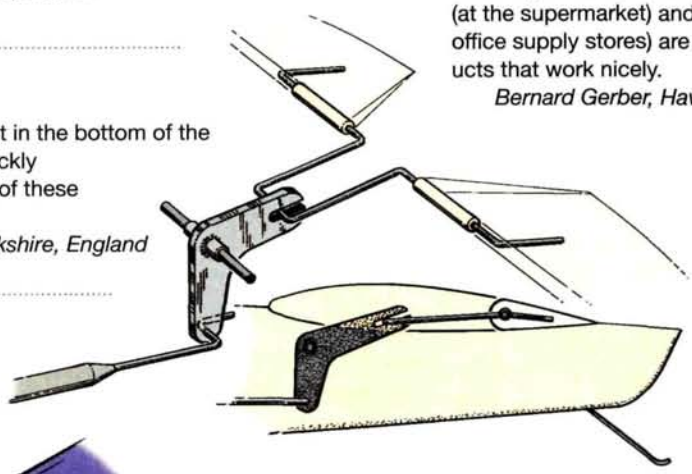
Bernard likes working on an ironing board because he can give his model all-round attention! Tape on a cover of resilient, non-slip material, and you have an extra pair of hands while you're covering a model. Rubbermaid Grip Liner (at the supermarket) and Easy Liner (at office supply stores) are two such products that work nicely.

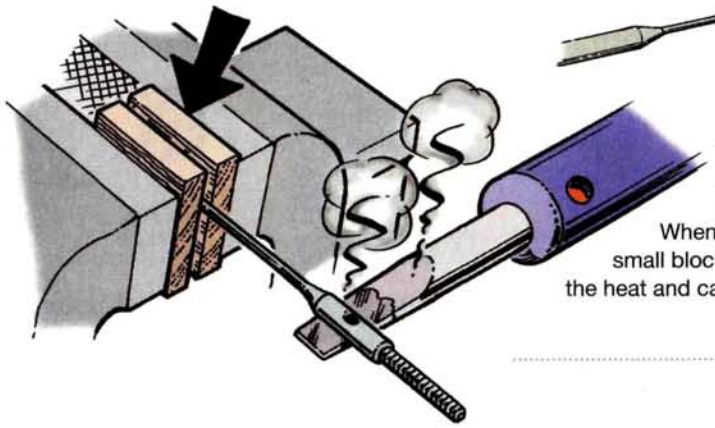
Bernard Gerber, Havre de Grace, MD

QD STABILIZER

This simple linkage, operating in a wide slot in the bottom of the antique's stabilizer, allows the tail to be quickly detached for transportation. The elevators of these models need little movement.

Phillip Kent, Cleckheaton, W. Yorkshire, England





KEEP THE HEAT

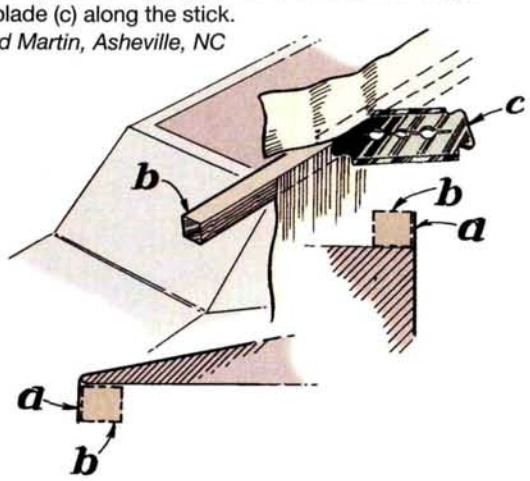
When holding small items in a bench vise for soldering, position small blocks of wood (arrowed) so the vise jaws do not carry away the heat and cause a cold solder joint, which is very weak.

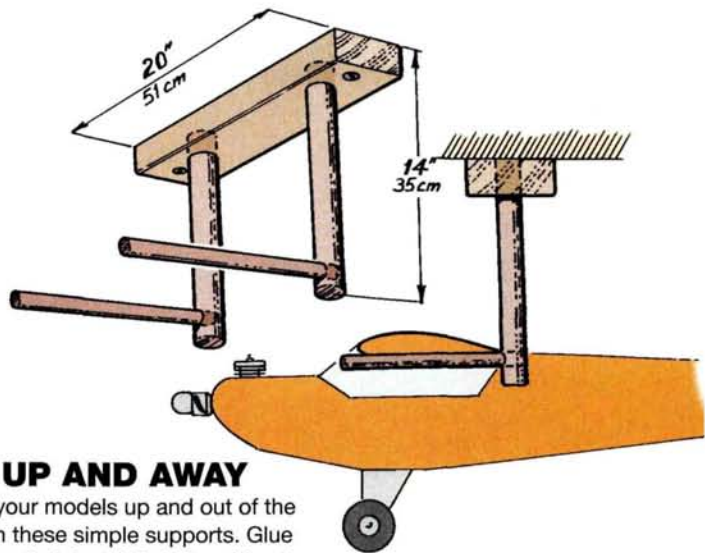
Jeff Shapiro, Columbus, OH

EZ TRIMMING

To achieve neat, constant-width overlaps (a) on your covering, lay a ¼-inch (6mm) stick (b) along the edge of the fuselage or trailing edge, then slide a double-edge razor blade (c) along the stick.

Edward Martin, Asheville, NC





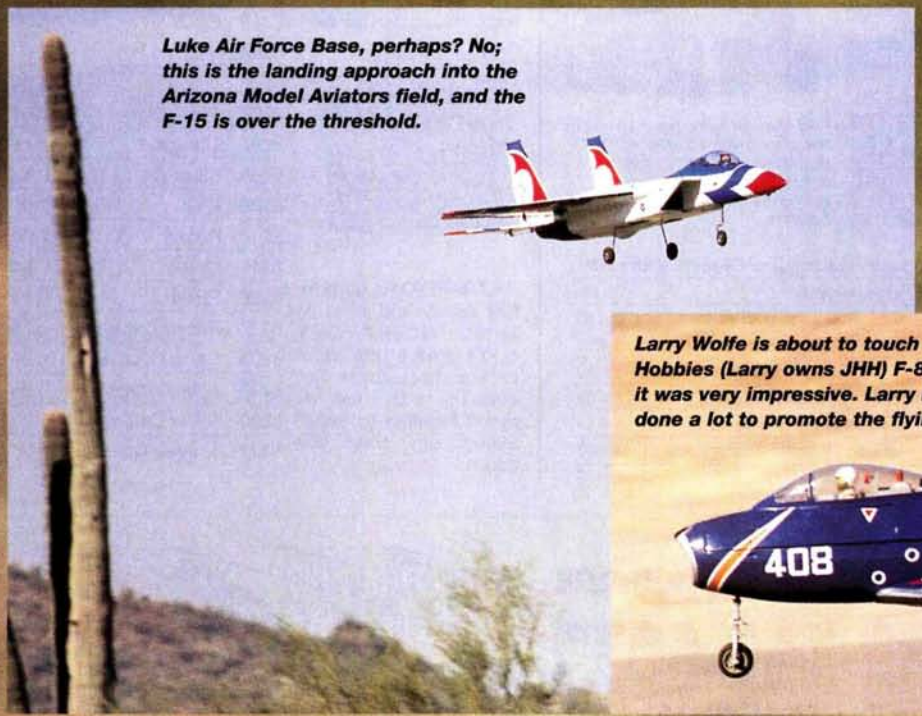
UP, UP AND AWAY

Hang your models up and out of the way on these simple supports. Glue together 2x4-foot (50x100mm) lumber and 1¼- and ½-inch (35 and 13mm) dowels, then screw the assembly to the ceiling beams, making sure you have fin clearance. These supports will easily support a Telemaster or similar model.

Leland Voll, Wainwright, Alberta, Canada

10th Annual ARIZONA JET

by LARRY MARSHALL



Luke Air Force Base, perhaps? No; this is the landing approach into the Arizona Model Aviators field, and the F-15 is over the threshold.

Larry Wolfe is about to touch down with his Jet Hangar Hobbies (Larry owns JHH) F-86. Powered by the new K&B .48, it was very impressive. Larry is also a really nice guy who has done a lot to promote the flying of scale jets.

RALLY

Main image: Kent Nogy's turbine-powered Bandit on approach. Top left, opposite page: if attendance counts, the Bandit was the most popular plane at the event. Top left, this page: Andreas Geitz's FiberClassics Kangaroo doing a flyby. It's powered by a Sophia 850. Above: this magnificent A7 Corsair is a Jet Hangar Hobbies model built by Frank Buelna. It's powered by a Golden West turbine.

Below: this is Bob Ruff's Kyosho T-33. He flies it with the stock fan and 8 cells. He added the landing gear himself.

PHOTOS BY LARRY MARSHALL

BY THE TIME NOVEMBER rolls around, most of us in the Northeast are thinking about hanging up our airplanes and huddling around the fire. Hopefully, some of you have your copies of *Model Airplane News* at your side. But jet guys aren't like that, it seems; they migrate.

When fall turns the weather cool in the Northeast, the modeling community has great jet events in the Southwest, including the Arizona Jet Rally that's hosted annually by the Arizona Model Aviators. This year was the 10th anniversary of the event, and everyone turned out in force, with 114 pilots and—by my exact count—oodles of jets. The event is well advertised in the area, and the club has turned it into a great public relations coup for model aviation. They get several thousand spectators who sit in the grandstands, take in all the activities, win prizes for answering aviation-related questions that are asked by the announcer, and generally have fun while getting a taste of what we do. Kudos to the organizers for taking these extra steps to promote model aviation.

ARIZONA JET RALLY

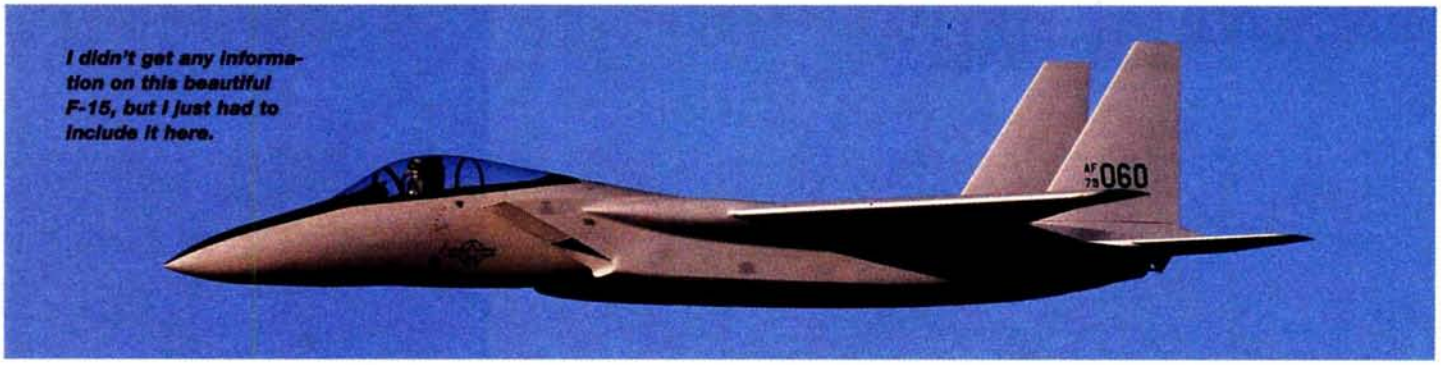
1998 AWARDS

People's Choice—Scale	Kent Nogy	BVM F-4 Phantom
People's Choice—Sport	Bob Violett	BVM Bandit "T"
Best Graphics and Markings	Mike Chan Su	BVM F-16
Best Boeing Jet	Gary Hanifin	F-4 Phantom
Best Scale Flight	Dean Lassek	¼-scale A-10
Best Electric Jet	David Reynolds	A-10 from MAN plans
Best Turbine Performance	Dean Lassek	¼-scale A-10
Best Flameout	Paul Munninghoff	F-104

Here's Bob Violett Models' newest jet: the MiG-15. This one happens to belong to Bob Violett himself. That's him in the upper right photo, with Kent Nogy assisting. This is one sweet flying machine, and Bob knows how to make it look good in the air.

Dean Lassek's huge A-10 is awesome, especially now that he has it powered by two RAM 750 turbines. Rei Gonzales of R.A. Microjets did the flying honors.

Nat Lancaster likes JMP Starfires, and he has two beauties. One is powered by a ducted fan system, while the other gets pushed along by thrust generated by a Golden West turbine. Nat likes to go fast, and he does so in style.



I didn't get any information on this beautiful F-15, but I just had to include it here.

Bob Ruff and Austin Goodwin are CDs for this event, and a bunch of great guys work long and hard to make it run smoothly for the pilots. And smoothly it did run, as a steady stream of jets was taking off and landing in such tight sequences that you'd think they needed traffic control. In truth, they did; and this was provided by the organizers, who had walkie-talkie-equipped pilot spotters to call takeoffs and landings for the pilots so they'd know what was going on in the airspace without having to worry about it. Yes; it's an enjoyable place to fly. The fact that Bob pulled some strings and provided us with three days of beautiful blue skies and low winds was the *coup de grace*.

One of the neat things about the Arizona Jet Rally is the diversity of aircraft you find there. There were well over 20 manufacturers of jet aircraft represented and several scratch-built projects. In the case of some of the popular sport jets, you could use the event as a chance to pick a color scheme for yours. For instance, there were 14 BVM* Bandits in attendance with military and sport markings. This jet has really grabbed the hearts of a lot of modelers. Bob Violett flies one himself, complete with smoke system and powered by a RAM* 750 turbine. Bob also had his new product, the Dave Ribbe-designed MiG-15. In the hands of Bob or Dave, this plane really looks good in the air. It was one of my favorites.

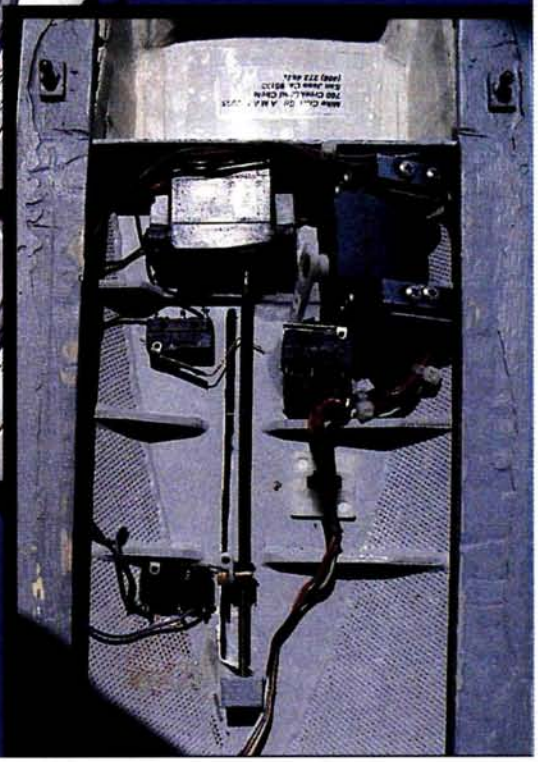
The Top Gun* F-15 continues to be popular, both as an entry-level jet and as an all-around fun jet. Its docile yet aerobatic characteristics make it ideal for the sport jet flier who's looking for a scale model. I don't know how many F-15s were there, but one that always catches my attention is the one flown by Paul Munninghoff, mostly because it finds its way, inverted, just inches off the deck. Paul does his best to catch your eye.

This is Larry Wolfe's favorite event and so, of course, he was there, flying his new F-86 with the prototype for the new K&B* .48 (see sidebar, "New ducted fan engine from K&B"). In fact, there were a lot of Jet Hangar Hobbies* aircraft in attendance. I'm partial to Roy Mills' Panther which, though not finished, sure looks good. Roy has a Golden West* turbine going in the belly of it, and I can't wait to see it in the air.

SLIDING CANOPY

Mike Chan Su brought along his Bob Violett Models F3J Fury. This plane was decked out to the nines with operating tailhook, speed brakes, sequencing doors and the neatest sliding canopy you ever wanted to see.

The mechanism was actually quite simple—a jackscrew-driven connection to the canopy. The jackscrew was connected to a servo with its centering pot removed. The opening and closing speed was realistic and impressive. It was a really nice touch on this gorgeous model.



Mike's jackscrew sliding canopy system is simplicity personified; it's also elegant.

Electron-driven ducted fans

The electrics community has gone ducted-fan-crazy in the past couple of years. And why not? Modelers are having a lot of fun working mostly with small fans and power systems to investigate the potential of electric jets. While most of the effort has been with small, inexpensive power systems, larger electric ducted fan (EDF) systems have considerable untapped potential to produce first-class but quiet jet aircraft.

This activity was reflected in the large number of EDF aircraft that showed up at this year's Arizona Jet Rally. This year, the organizers allowed electrics to fly from 7 a.m. to 9 a.m. (noisy jets couldn't fly until 9 a.m.), and the time was well used by the electron tamers.

Ivan Munninghoff was flying his Robbe* Gnat, putting on a typical aerobatics show, albeit with maneuvers being smaller than when he flies his glow-powered jets. This didn't seem to matter, though, as the maneuvers were also done much closer to the pilot for all to see. He later put on a show with Robert Wagner's A-10, also an electric model.

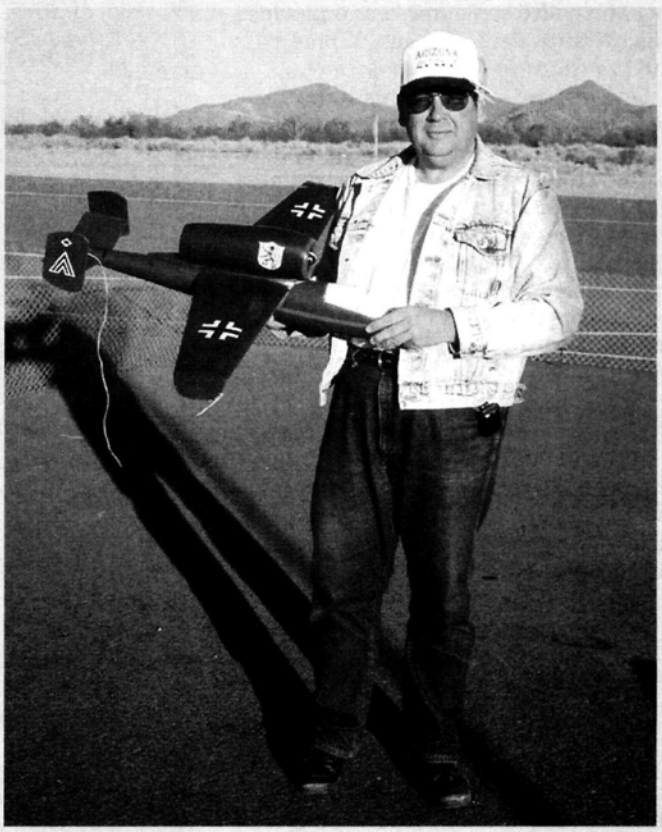
Speaking of Robert, he's the owner/proprietor of the Electric Jet Factory* (EJF), a small company promoting the flying of electric jets. He and Bob Ruff were flying the new EJF Rafale; this is a glass/foam kit set up to be powered by two fans. Bob Ruff flies his using two AstroFlight* 020 brushless motors, and Robert was using a couple of Astro sensor-less 05 brushless motors that are in the prototype stage. These planes fly very well, though Bob Ruff beat Robert hands down in the "biggest grin while flying" contest. Bob does like flying airplanes.

David Reynolds won best electric jet with his scratch-built A-10 built from *Model Airplane News* plans. Powered by two homemade fans and Speed 480 motors, it flew very convincingly.

A report on electric ducted fans would not be complete without mentioning the Kyosho* T-33, which seems to have taken the model aviation community by storm. This nicely crafted foam model builds quickly and easily and flies great. Lots of folks are pumping up the horsepower with better motors—an extra cell or two—and really having a ball.

The future of electric jets looks bright. In any case, it will be interesting to see what develops.

Robert Wagner's A-10 sure looks good in the air.



Top: Bob Ruff's Rafale, an Electric Jet Factory kit, is powered by two Astro 020 brushless motors. Above: Bob is holding his HE-162. Bob was also one of the CDs of the event.

Dean Lassek was there with his huge A-10, powered by two RAM 750 turbines. Rei Gonzales of R.A. Microjets flew it for him, and it was really impressive in the air; the RAM 750s improved performance considerably over the ducted fans they replaced.

Speaking of Rei, last year, he flew the one and only RAM turbine. In fact, it was the prototype for the RAM 750. This year, only 365 days later, 22 aircraft were powered by this turbine. The ease of use, kerosene-based fuel and reliability have made it a winning ticket in the world of turbines.

One of the truly striking things about this year's Arizona Jet Rally was the number of turbines present. Not very long ago, they were a rarity that made you stop whatever you were doing to watch. But there were so many turbines at this meet that the word "commonplace" comes to

mind. In fact, I was standing on the flightline Friday about noon. We heard a ducted fan spool up and head down the runway, and someone in the group said, "Hey, someone's flying a ducted fan." Now, that might be a bit of an overstatement about what's going on in the world of jets and at the Arizona Jet Rally, but it did make us stop and think about how many turbines we'd seen flying after only a few hours of flight time.

FiberClassics* attended the meet to show off its new Kangaroo. The company's goal is to make it easier to get into turbine technology, and its Kangaroo is designed to be easy to fly and—with the turbine resting on top of the airframe—to offer easy access to the turbine. They're selling the Sophia turbine, with a highly prefabbed kit, for $2,995. They fly great, too. Andreas Geitz of FiberClassics was flying his with a Sophia 850.

The three days of flying were absolutely fantastic. Jets present new challenges, and these are being met on many levels by their devotees. Mostly, they're having fun, and that's what it's all about. The Arizona Model Aviators put on a great show at this, the 10th anniversary of the event. I'm sure the next 10 will be even better.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

NEW DUCTED FAN ENGINE FROM K&B

I don't know if you've noticed, but good things are happening at K&B these days. They have upgraded their epoxy paints and have started releasing a new line of superb-running engines. It looks as though they have a certain winner in ducted-fan circles with their new .48DF.

While .70 to .90-size jets are very popular, they also tend to be pricey and require large flight areas. They've been favored by many, though, because they have enough power to easily fly a jet like a jet. Even so, the smaller, Turbax/K&B 7.5 power system has remained popular because it's possible to put a jet into the air at a very reasonable cost and still have pretty decent performance. The new K&B .48DF takes this approach, and the planes that have flown with it, to a whole new level of performance.

Larry Wolfe was flying the prototype of this new engine in his new Jet Hangar Hobbies F-86, and its performance was head and shoulders above the other jets of this size. Though he wasn't trying to go fast, at one point, 141mph was recorded by the speed traps, and he could do loops as large as he pleased. It was one sweet flying machine, and Larry's piloting skills showed it off well. Maybe best of all, he seemed to be able to fly forever, as the K&B sips fuel much more slowly than the .91 guzzlers.

So if you're interested in any of the smaller jets, keep an eye out for the release of the new K&B .48DF; it's awesome.

While the K&B .48DF wasn't available at the time of the event, the prototype's performance clearly made it the ducted-fan engine performance highlight of the event.

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THUNDER TIGER

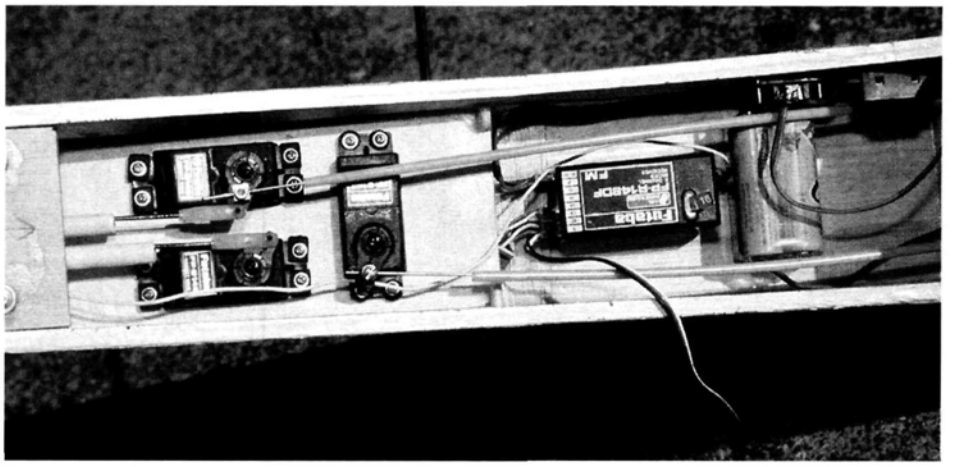
by Craig Trachten

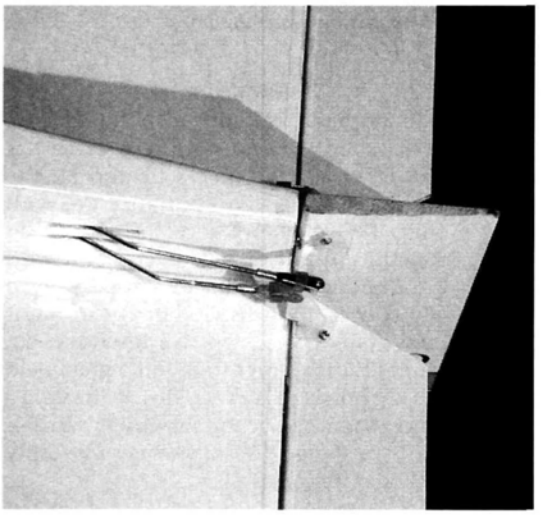
Champion 45s

Sleek ARF pattern ship

BORED WITH YOUR present arsenal of aircraft? Ready to take the next step? If you want something that's relatively inexpensive and can be assembled quickly, take a look at the Thunder Tiger* Champion 45S. The Champion is a long, sleek, ARF pattern ship with a thick-profile, symmetrical wing that you can fly almost as slowly as a low-wing trainer and as fast as your engine/prop will allow. Because it's remarkably stable, the Champion is a great aircraft to use to learn and practice inverted flight, knife-edge and other stunts and maneuvers.

Assembly is rather easy, assuming that the Champion isn't (and it shouldn't be) your first airplane. The pre-assembled parts and other construction supplies, documentation and photos are excellent. You only need to supply a 4-channel radio and equipment and a .45 or .46 2-stroke engine. Instead of writing a "Readers' Digest" version of the instruction manual, I will give a few hints and tips that I picked up while assembling the Champion.





Above: the fuselage is narrow but can easily accommodate the radio equipment and battery.

Left: the tail feathers fit together well. To feed the Y-elevator pushrod through the fuselage, I first installed a plastic pushrod chase through the openings in the fuselage.

SPECIFICATIONS

Manufacturer: Thunder Tiger

Model name: Champion 45S

Model type: ARF pattern ship

Length: 53.3 in.

Wingspan: 56.2 in.

Wing area: 623 sq. in.

Weight: 5 lb., 15 oz.

Wing loading: 21.96 oz./sq. ft.

Engine req'd: .45 to .46 2-stroke

Engine used: Thunder Tiger Pro .46

Prop: APC 11x6

Radio req'd: 4-channel

List price: $239.99

Features: sleek, low-drag design. Symmetrical airfoil in shoulder-mount configuration. Side-mounted engine. Ninety percent pre-built.

Comments: this is an aircraft that you will enjoy. It is a great choice when you are looking for something new to add to your air force.

Hits
- Well built.
- Looks great.
- Easy assembly with great instructions.

Misses
- None.

ASSEMBLY HINTS AND TIPS

• **Wing**. I always use 2-hour epoxy to attach ailerons to the wing halves. The 2-hour epoxy is thinner than other epoxies, so it flows better. I make sure that the hinge holes are clear of covering material and, using a toothpick, drip epoxy into the holes in the wing half until they're about half full. Lightly oil the pivot point of each hinge, then put a hinge point into the hinge openings in the wing half and work the hinges to be sure they are free of epoxy. Now, attach the aileron to the hinges. Work the ailerons to be sure the hinges line up and don't bind. This is another reason I use 2-hour epoxy: there's time for final adjustments. After the epoxy cures, I repeat the process on the rudder and elevator.

I use 30-minute epoxy instead of 5-minute to join the wing halves because 30-minute epoxy creates a stronger bond and allows you additional work time.

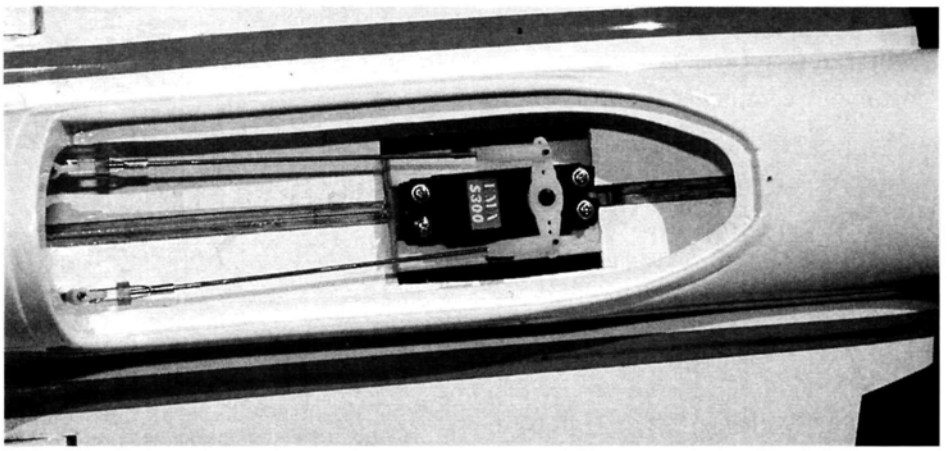
• **Fuselage**. The only helpful hint I have concerning the fuselage assembly is that when you drill the wing mounting holes, use the rear turtle deck as your guide and make sure that the drill is parallel to the rear of the deck (I didn't, and I had difficulty attaching the wing. I ended up replacing the mounting block in the fuselage and re-drilling.)

• **Cockpit and canopy**. If you want to be on the cutting edge, invest in a pair of Lexan scissors. Hobbico* has just introduced canopy scissors, which have a slight curve to their cutting edges. With small bites, you can cut a straight line, but what's really neat is that you can cut "clean" curves.

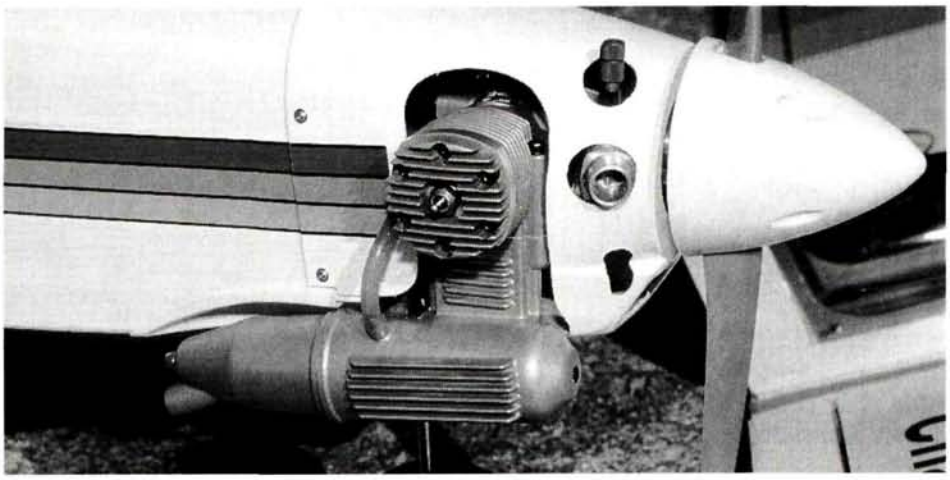
Attaching the cockpit to the wing can become messy, so I *never* use CA as instructed. In this case, I used an aliphatic glue. You can wipe away ooze with a damp paper towel, and it's strong when it dries.

• **Cowl**. I used to hate two-piece cowls. No matter how careful I was, I would dribble CA all over the place. Then I came up with a better method. I now tape the halves together with masking tape *without* glue. When both halves are lined up to my satisfaction, I place a few drops of CA gel on the seam line on the *inside!* Then, using 30-minute epoxy, I epoxy over the seam and lay a strip of 1½-inch fiberglass tape over the joint. This way, I end up with a strong, clean cowl that doesn't need sanding or painting.

• **Pushrods**. The only problem you might encounter when you install the pushrods



The aileron servo compartment.



A side-mounted Thunder Tiger Pro .46 engine provides the power.

is feeding the Y-elevator pushrod through the fuselage. To make my life easier, I always feed plastic pushrod chases through the exit opening to the servo compartment. Place each end of the pushrod into a plastic chase and push! The pushrod should feed through the fuselage easily and right out through the exit openings.

• **Control-surface deflections**. Adjust your throws as instructed. If your transmitter has dual-rate capabilities, using 75 percent of full throw as the low rate worked for me. I use a Futaba* 8UAP transmitter that like many other computer transmitters, lets you really play with your setups. Adding some exponential will also help fliers with twitchy fingers.

SUMMING IT UP

This kit was a pleasure to build. There's nothing better than putting together an ARF when all the pieces fit and all the pre-constructed components are well built. This is one of a very few ARFs on which I did not go over every joint with CA. The only other idea I can pass on to you concerning this aircraft is turning it into a tail-dragger, which I intend to do. I find that it's easier to fly off a grass field with tail-draggers (I don't have to straighten those nose-wheel wires). Sullivan's* no. 860 tail-wheel assembly will be my choice.

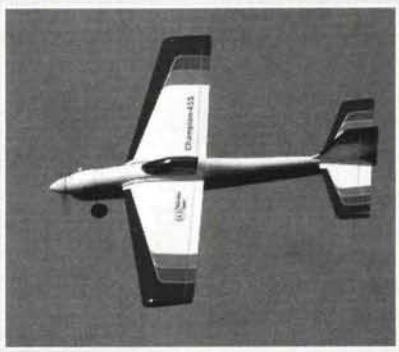
** Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING

Being a trike gear, the Champion 45S is easy to deal with while it's on the ground. Takeoff was mostly a matter of advancing the throttle. The plane required a bit of aileron trim.

Landings were similarly uneventful, as the plane seems to drop in without input other than a bit of throttle to control the descent rate.



• LOW-SPEED PERFORMANCE

This plane maintains very good control at low speed, although I felt the aileron throws needed to be increased above the settings provided. At slow speeds, axial response was sluggish because of this. Stalls were gentle and recovery was easy.

• HIGH-SPEED PERFORMANCE

The plane tracks well at high speed with no bad habits, and control authority is increased. Downthrust as recommended in the manual seems about right.

• AEROBATICS

With increased aileron throws, the plane does nice axial rolls, and slow rolls are easy. Loops, avalanches and Cubans were as crisp as you would expect from a plane with this planform. Inverted flight is as easy as upright, and though you'd have to work with trim a bit to get it flying completely neutral (as you would with any aerobatic plane), this sport plane could be an entry into flying pattern maneuvers.

Competition quality in a small package

HIROBO

Shuttle RG

by Rick Bell

IT'S BEEN SAID that if it looks like a duck, walks like a duck and sounds like a duck, then it must be a duck. Though Hirobo* Shuttles have been around since 1985 and are probably responsible for introducing more modelers to R/C helicopters than any other helicopter, they all kinda look the same, are built the same and fly the same—until now, that is, as Hirobo has introduced the Shuttle RG (Revolution Gold) .30-size helicopter.

The Shuttle RG is totally new and features a metal stacked-frame chassis and a new high-performance metal SZ-III rotor head. After checking out the world-class .60-size Eagle II at the Hirobo Cup this past fall, I can see where the design came from. This .30-size heli looks like Hirobo shrunk an Eagle II, which is not a bad thing because Manabu Hashimoto won the 1997 F3C Helicopter World Championship using a Hirobo Eagle IIEX. Perhaps Hirobo should have named this new heli the "Eaglet"?

Other Shuttle RG features include closed-loop push/pull linkages on both cyclic controls (elevator and aileron), all-metal construction, ball bearings on all pivot points, a beautiful gelcoated fiberglass canopy, new larger tail fins for better forward flight stability and a top start system.

Rick Bell (left) and Larry Marshall (right) with their Shuttle RGs.

WHAT'S IN THE BOX

When you open the box, you are immediately struck by the packaging. All of the pre-assembled components, such as the rotor head, tail gear, main gear, swashplate, washout assembly, clutch-bell housing and bearing blocks are in a

SPECIFICATIONS

Model: Shuttle RG

Type: helicopter

Manufacturer: Hirobo

Distributor: Altech Marketing

Main rotor diameter: 1,240mm

Length: 1,075mm

Radio used: Futaba* 9Z

Radio req'd: 5- to 6-channel heli radio

Engine used: O.S. 32SX-H and MDS .38 FSH Pro heli

Price: $569

Features: all-metal construction, new SZ-III aerobatics rotor head, lightweight fiberglass gelcoated canopy, stacked metal-frame chassis, bearings on all pivot points, new horizontal fin for flight stability, good manual, easy construction.

Comments: the Shuttle RG is a great performing helicopter. It's easy to build, maintains setup well and has rock-solid flight characteristics for beginners and experts. No upgrades are required. The given curve settings in the manual work well for general-purpose flying.

Hits

- Easy to build.
- All-metal construction.
- Full complement of bearings.
- Good setup instructions.
- Solid flight performance.
- Gelcoated canopy.
- No upgrades needed.

Misses

- Should come with main rotor blades.

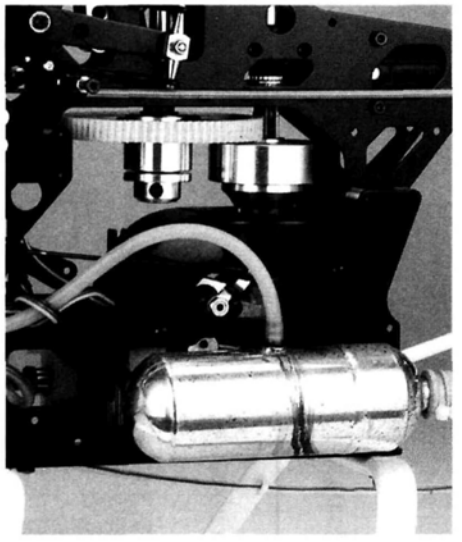
FLIGHT PERFORMANCE

Helicopter flight performance reviews are very subjective. Many variables influence how a helicopter performs; for example, the weight of the paddles helps determine cyclic response. Heavy paddles equal slower cyclic response, while lighter paddles have the opposite effect. I set up the heli using the figures given in the manual because most modelers would use these as starting points. I also used full symmetrical fiberglass main rotor blades for aerobatic performance.

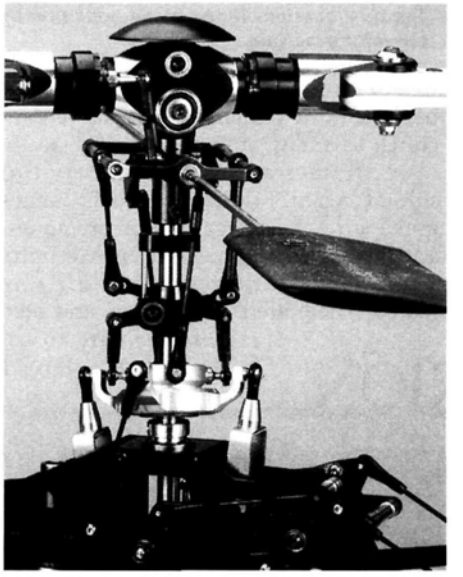
First lift-off was quite a surprise. There were no shakes or vibrations anywhere on the heli. Everything was smooth; even the fuel in the tank was not moving! No trim changes were needed on the cyclic, and the tail-rotor trim was almost perfect. The main rotor head speed was a little on the high side, so the throttle curve was adjusted down a little.

Once this had been done, the handling qualities could be evaluated. Control response was very solid and precise without being twitchy or overly sensitive—a very nice, balanced feel unlike any .30-size heli I've ever flown. After a few tanks of fuel had been run through it, all fasteners were checked to see whether anything had come loose. Everything was found to be in order. On the next flight, idle-up was engaged, and a few forward flight circuits were made to get a feel for forward flight. With the recommended pitch and throttle curves, aerobatics were a breeze. Loops, rolls and 540 stall turns were fun to do. Mild 3D aerobatics are also possible with the recommended settings. Changing the curves to full 3D settings would allow just about any maneuver.

windowed foam shadow board box. The quality of the workmanship is very evident. The metal rotor head really jumps out at you; it's black anodized with natural metal highlights. The rest of the kit is in two boxes: one holds all the various parts in numbered bags that correspond to the numbered steps in the construction manual; the other contains the fiberglass canopy, tinted windshield, colorful decal sheet, construction manual and safety notes. Also, the tail boom and boom supports are painted white—a very nice touch. The kit does not include main rotor blades; a lot of other high-end heli kits no longer include main blades. I guess the manufacturers feel that the buyers already have a preference in this area and would not use the included blades. I wish that manufacturers would stop this trend, as some modelers cannot afford expensive glass blades after buying the kit.



The all-metal frame is nearly identical to that of its big brother, the Hirobo Eagle II.

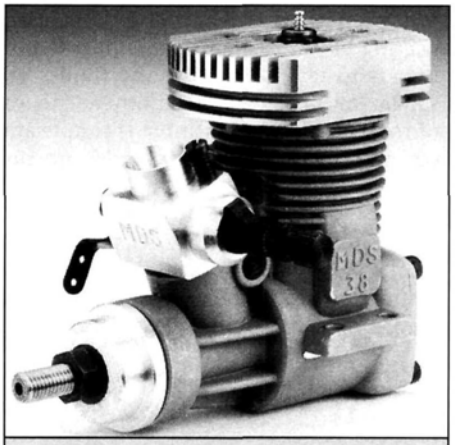


The all-metal, pre-assembled SZ-III rotor head brings competition precision to the Shuttle line.

CONSTRUCTION NOTES

This review is not intended to be a blow-by-blow breakdown of each assembly step. Instead, I'll cover those areas that need special attention or are not so obvious in the construction manual. So let's get started!

• **Elevator assembly.** First mount the ball-link ends to the A-arms because once the A-arms have been mounted on the elevator lever, getting to the screws that hold the ball links in place would be more difficult. There are several tiny washers in this assembly. Be sure to use them; they are spacers that prevent the pivot bearings from binding when the mounting bolts are tightened down. Also use a drop of Loctite* on the setscrews that hold the elevator pivot shafts in place.



MDS HAS A WINNER

MDS has a new series of helicopter engines on the market. I wanted to compare the king of the hill O.S. 32SX-H against the newcomer MDS .38 FSH. The MDS .38 comes with an accessory tool set, muffler mounting bolts and extended throttle arm. Fit and finish are very good. That's quite a package for just over $100. I flew my Shuttle RG with a new O.S. .32. After bench-running the MDS (as I had run the O.S.), I mounted it in the heli, and since it has the same footprint, this was a breeze.

The results were pleasing. The engine hovered well and had plenty of power; in fact, it seemed to have a little more on the top end, as I could pull a little more top-end pitch. All in all, the MDS is a powerful engine that has a lot going for it. It runs leak-free, looks good and has a three-year warranty. Give one a try.

• **X-levers.** The screws that hold down the balls stick out past the molded boss. These screws need to be ground down a little, as they will interfere with the pushrods when mounted. I used a Dremel* tool with a stone to accomplish this.

• **Upper frames.** First I check the frames for straightness; I use a large piece of plate glass to do this. I lay the frames on the glass to see if they are bowed. If they are, I gently tweak them until they're flat. Mine were OK. Next, two flanged bearings must be pressed into the frames. To avoid stressing the bearings, I put them in the freezer for about half an hour; after that, they just drop into place. When placing the bearings in the frame, make sure you make a left frame and a right frame. When the frames are assembled, the flanges on the bearings should face toward the inside of the frames. Before I start to tighten the frames together, I use the main shaft in the upper and lower bearing blocks to align them. Most important is to make sure that the frames are square and level with each other. The rest of the upper frame assembly is simple and covered well in the manual with no surprises.

• **Engine/drive assembly.** First, the cooling fan is mounted to the flywheel. The instructions are good here, but there's no mention of balancing or dial-indicating the fan and clutch; these tasks should be done now. The engine/cooling fan and clutch assembly are now mounted to the lower frames along with the cooling shroud. Again, just like the upper frames, make sure the lower frames are square and level before you tighten the bolts. The upper and lower frames are now mated. There are many spacers and bolts here; be sure to use the correct length bolts, as indicated in the instructions. The starter shaft and clutch bell are also installed now; be sure to lightly grease the starter shaft for smooth operation. When installing the fuel tank, be sure to put two layers of the supplied servo tape on the front of the tank to prevent it from chafing against the vertical frame support.

The dual bearings in the blade grips greatly improve tail rotor precision.

The pre-assembled main gear is installed next. You now must decide whether you want a driven tail rotor during autorotations. Two shims of different sizes are to be installed under the main gear. Beginners should not use these shims because if the engine sputters or runs rough, the tail rotor will kick. Be sure to pull up on the main mast tightly before you tighten the mast lock. The gear should have no up or down play in it.

• **Seesaw/flybar.** Assemble the seesaw and flybar assembly and join to the pre-assembled SZ-III main rotor head. No surprises here; just make sure the flybar is centered and the paddles are screwed on equally. Speaking of the paddles, Hirobo has finally changed them for this kit; gone are the paddles that must be covered. Also, the new paddles have weights in them that can be removed for quicker cyclic response.

Next, screw the balls to the pre-assembled

A SECOND OPINION

If you've been following *Model Airplane News*, you know that I've just gotten into helicopters. My Hirobo Shuttle Z-TS has quite a bit of air time, and I'm at that dangerous stage where I think I know what I'm doing. When I saw a Shuttle RG at last year's IRCHA show, I knew I had to have one. Through my newbie-helicopter-guy eyes, it looked ... umm ... perfect. It had the familiar shape of my Shuttle, yet all the metal-anodized parts and the more precise belt drive and the glass canopy just oozed perfection. I had to have one.

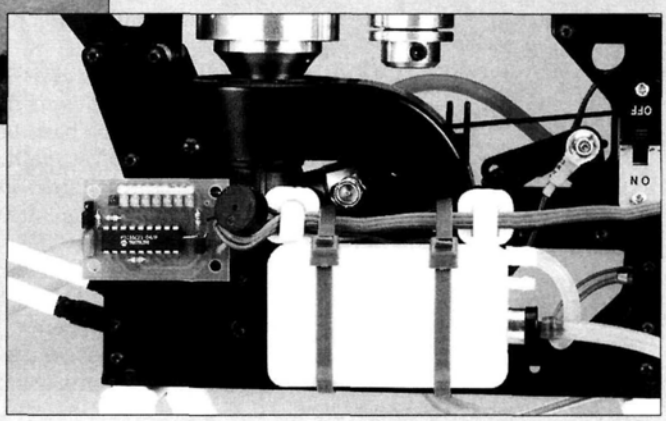
And while I can't yet benefit from its ability to do aerobatics as Rick can, I still love my RG. The words that both Rick and I have used to describe it while hovering are "sewing machine"; it just hums, not moving at all unless my thumbs tell it to.

Here's the right side of my RG. See the text for details.

I set my Shuttle RG up a bit differently from Rick's version. While he used nice, but expensive, glass blades on his, I tried the new pre-covered, pre-balanced 550mm wood blades from Revolution* (part no. RV00550C). What surprised me was that when they say "balanced," they mean it, as they were bang on when we checked them. I used an Enya 35X for power. This is the ABC version of this engine, and so far, I've been impressed with the performance.

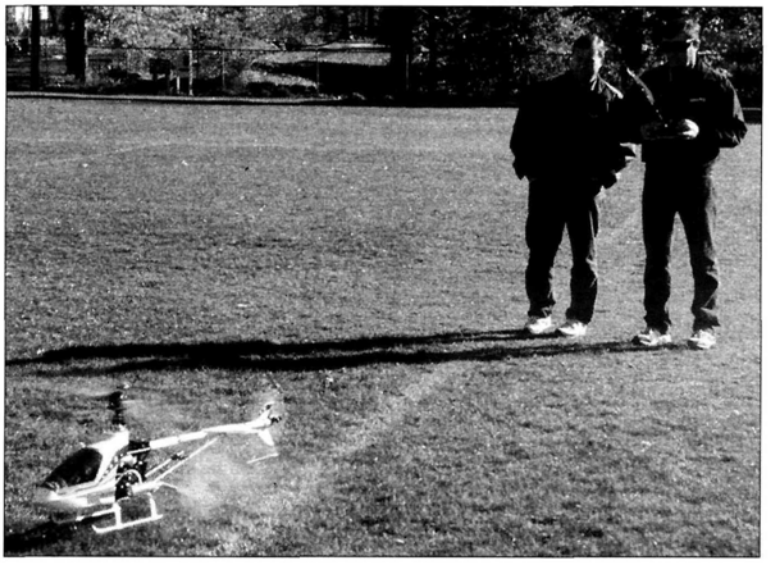
I splurged and bought a CSM* heading-lock gyro and the new JR* 2700 Super Servo for the tail. Is it ever neat! Response is really quick and precise. I tend to fly without heading lock most of the time because practicing tail-rotor control is something that a beginner should do—a lot. But it's pretty neat to turn the heading lock on when I practice hovering at new attitudes and altitudes, as I can work on the visual aspects of hovering with the heading lock helping me to maintain helicopter orientation. I'm using my trusty JR8103 transmitter to talk to this hardware.

I didn't like having to go hunting under the RG for the glow plug during the start-up procedure, so I



wash-out unit and swashplate; be sure to use Loctite on the screws. The swashplate, washout assembly, radius block and main rotor head are now slid onto the main shaft. Be sure to line up the radius block per the manual; if you don't, the cyclic response will not match the transmitter commands.

• **Tail rotor.** The tail box is pre-assembled, but grab the output shaft and see if there is any play back and forth. If there is, it must be eliminated. The kit provides shim washers for this, but no mention of them is made in the manual. If you need to remove any play (as I had to), remove the left side plate (you need to do this anyway to install the drive belt on the pulley), and use the appropriate number of shims. I needed only one shim. An improvement that Hirobo made in the tail rotor is in the blade grips; there are now two radial bearings to support them. The drive belt is snaked down the tail boom, and the tail-rotor assembly is installed in the tail boom along with the vertical fin. The boom is now mounted on the chassis and the belt tension is adjusted per the manual. Be sure the drive belt is twisted as illustrated in the manual. Install the horizontal fin and boom supports, and that completes the basic helicopter.



RADIO INSTALLATION AND SETUP

Servos are installed in the chassis using the supplied spacers and screws. Pay attention to the placement of the spacers. If you're confused, check the pictures on the box; this will help make their positions obvious. Next, make up all the pushrods to the lengths stated in the manual (a handy metric ruler is printed on the page). Follow the manual for pushrod installation and for servo-arm placement. Hirobo has done a great job of clearly illustrating where the pushrods attach to the servo arms and how all the bellcranks and levers should be in relation to one another. Once this has been done, you can use the graphs in the back of the manual to set up the pitch and throttle curves. Now assemble the canopy, decal the model, do a final check of all components, and it's finished—ready for flight.

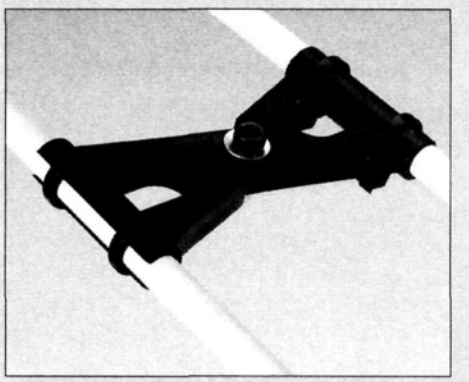
FINAL THOUGHTS

The Hirobo Shuttle RG is a very high-quality, top-of-the-line, all-metal .30-size helicopter. It assembles quickly and easily; I had no problems with any parts fit. While the manual could use a few more written notes, the exploded illustrations and full-size drawings of the small parts for each assembly step do help make assembly easy. Flight performance is outstanding, as it should be, considering what its big brother is. Even though it's a .30-size heli, it feels much more like a .60-size heli, only lighter. After several gallons of fuel through it, the heli shows no sign of any wear; I've only had to keep it clean. All in all, a very nice helicopter that will give many years of service. Give one a try!

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ✚

installed a KSJ* remote glow extension. While I was talking with the KSJ guys, I also got one of their new tail-brace supporting bridges (KSJ535). This really stiffens up the tail and looks cool, too.

I installed a Century Helicopter Products 2-ounce header tank. I'm a big advocate of header tanks in both airplanes and helicopters, and this thin, square tank is a great solution, as it fits so nicely against the heli frame. If you need info on installing such a tank, check my diagram and description in "Getting Started in Helicopters" in the November 1998 issue. They really help improve fuel flow, and in the case of helicopters, they give you a good indication when you're into the last 2 ounces of fuel.



These new tail-brace bridges from KSJ are the cat's meow.

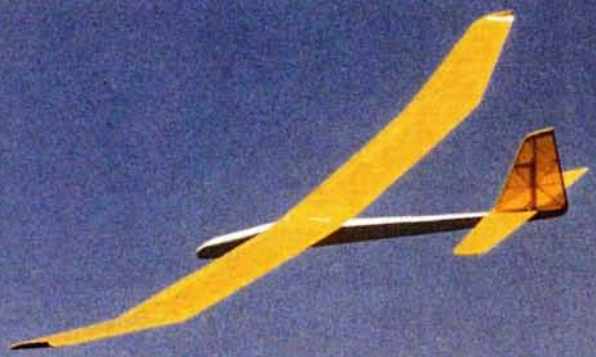
One last thing I did was install a YNT uDesign* (YNT stands for "You need this") BC-6 flight monitor. I figured that if I was going to fly a first-class helicopter, I should have first-class battery monitoring. The YNT monitor reports the lowest voltage experienced during a flight, which provides a much better indication of battery condition than checking them on the ground without flight loads on the control system.

But the BC-6 provides a lot of bonuses that are well beyond a battery monitor. First, it will report the number of glitches the radio saw during the flight. It also has a "lost-model locater," which amounts to a beeper that goes off if your radio loses signal. I'm unlikely to lose my helicopter, but I've found this to be one of the most valuable parts of the BC-6. There are two reasons I say that: first is that if I fail to turn my transmitter on (ever had a hot start on a heli because you forgot to turn the TX on?), I'll get a beeping noise that reminds me to turn it on; second, heading-lock gyros require a calibration period before they will activate. With the CSM, this is several seconds, and the end of the period is indicated by a slight wiggle in the tail rotor. Then it's OK to fire up. I find myself transfixed on the tail rotor waiting for that twitch, and sometimes I see it and sometimes I don't. But with my BC-6 wired via a Y-harness into the same channel as my gyro is plugged into, voilà; I had an audible indication of when the gyro is armed. The beep continues until the gyro is activated. This came, of course, as a complete surprise, but it was a pleasant one.

I've only flown a few helicopters other than my own. I like the two Shuttles I own, but it's clear there's a difference between the level of precision and response that I get from the RG and the Z-TS; in fact, I find the RG as responsive and precise as Rick's Schluter Futura SE .60-size machine, though the extra weight helps the Futura SE in a wind. I think that's saying a lot about the quality and design of the Shuttle RG, as you can buy two RGs for the price of a Futura SE.

—by Larry Marshall

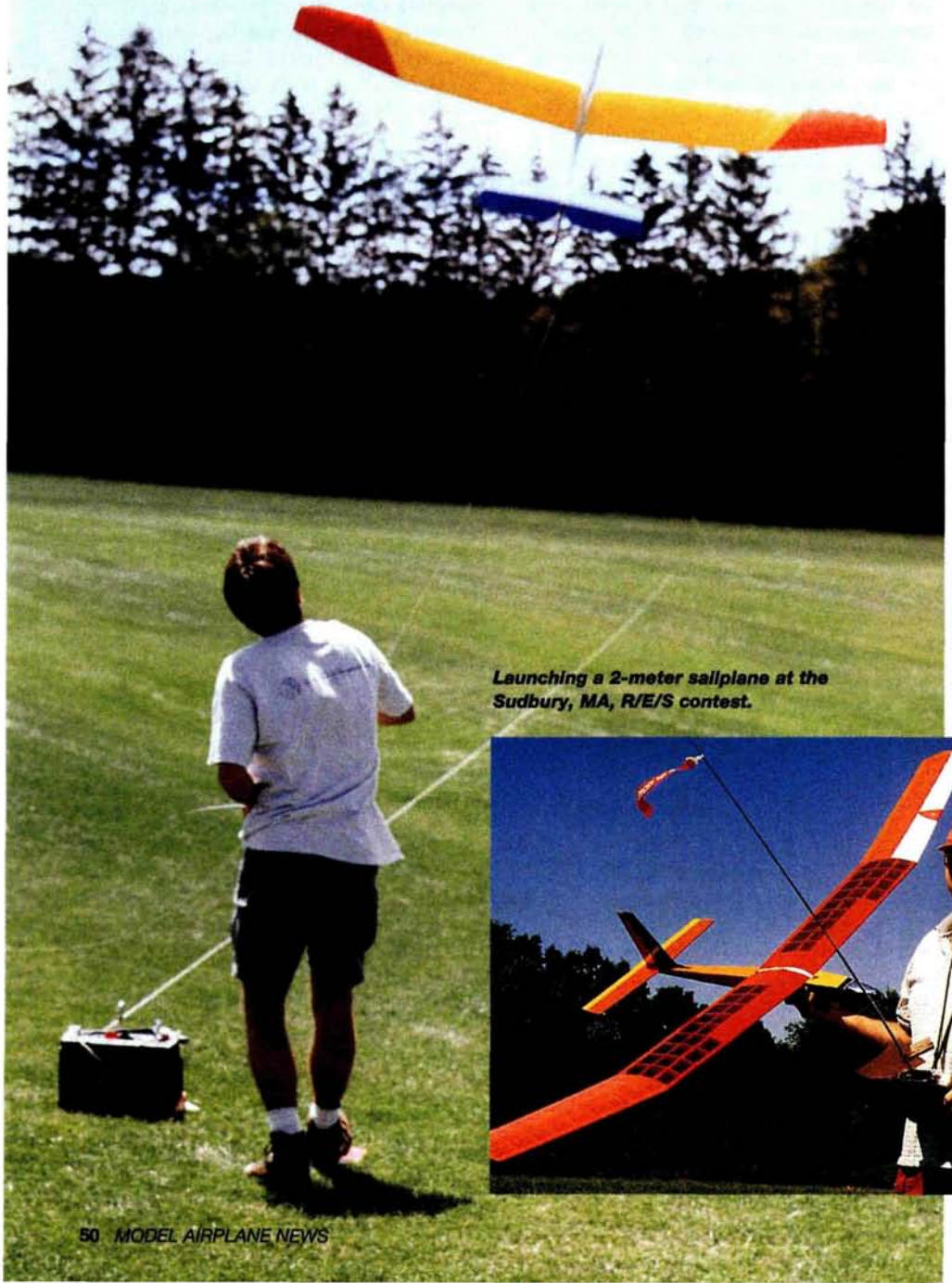
Rudder, elevator and spoiler events gain popularity



A peaceful, easy feeling comes from cruising on a breath of lift with your R/E/S sailplane. This is the author's Whyte Wings Olympic II.

A SHIFT TO SIMPLER SAILPLANES

by Dave Garwood



Launching a 2-meter sailplane at the Sudbury, MA, R/E/S contest.

ARE WE GOING back to the future? From the redwood forests of California to the clam beds of Massachusetts, the past flying season saw an explosion of soaring events scheduled for simple sailplanes.

There seem to be more wooden sailplane designs offered by more manufacturers now than at any time in the last 10 years. Most of these are proven designs that have been built hundreds of times by beginning builders and flown successfully thousands of times by beginning R/C pilots.

A scan of contest listings in magazines or soaring club Internet websites reveals an abundance of events for a competition class only rarely seen in previous years: R/E/S. Sometimes called "three function" sailplanes but more often "R/E/S" for rudder, elevator and spoiler, these planes may be any size, are simple in construction and stable in flight. Limiting the number of control surfaces on a sailplane helps bring simpler and less expensive gliders out of the attic, off the building bench and onto the flying field.

The Thousand Oaks Soaring Society in California held a "Bent-Wing, Three-Servo" event. Boston's Charles River Radio Controllers club (CRRC) put on an R/E/S contest with two

Walt Rady with his Carl Goldberg Models* Gentle Lady.

classes: 2-meter and unlimited span. The AMA/LSF Nationals in Muncie, IN, included an R/E/S event for the first time in 1998, in addition to the fourth running of a nostalgia event for planes designed before 1980.

HISTORICAL PERSPECTIVE

Early R/C sailplanes looked like the stick-built, free-flight planes from which they evolved. The boxes of balsa ribs and formers, spruce spars and maybe some plywood were all we knew because they were all we had. Parts were glued together with model airplane cement then pinned to the bench over the plans. This easy, inexpensive construction method yielded a plane that was quickly set up in the field and practically flew itself.

The polyhedral roll-control method worked because we thought the planes needed to be intrinsically stable to fly well—again, due to the influence of our free-flight progenitors. Back when radios were really expensive and servos were huge, rudder-and-elevator planes flew just fine with two control channels. Remember, Dave Thornburg designed the aesthetic Bird of Time for F3B (multi-task competition), and at the first F3B world championships, all the planes were polyhedral.

The introduction of spoilers gave R/C soaring pilots an extra dimension of control. Opening a spoiler on top of a section of the wing "spoils" the lift over that part of the wing and adds drag, slowing the plane and steepening its descent rate for a more precise landing. This gave us an alternative to diving to lose altitude, which increased air speed and sometimes pushed the plane faster than the fragile airframe could handle. With spoilers, competition pilots could score higher on landing tasks, and sport pilots had a new tool that made it easier to land in the same field as they had launched from.

Two-channel polyhedral sailplanes, sometimes with a third channel added to control spoilers, took us from the dawn of R/C soaring flight in the 1960s through the 1980s, when designers began working with fiberglass fuselages, space-age materials in the wings and more control surfaces on the wings: ailerons and flaps.

In 1990, Mark Allen's Falcon 880 offered a fiberglass fuselage, sheeted-foam wings and precision control of individual servos for not only rudder and elevator, but also a pair for the ailerons and a pair for the flaps. The Falcon took the thermal-duration competition scene by storm and spurred the development of even stronger sailplanes made from even more exotic materials.

The six-servo wonder ships captured the lion's share of magazine ink in the last decade, and for a while, it looked as though if you didn't fly one, you just weren't with it. But not everyone enjoys flying these fast, wide-ranging super ships. Not everyone relishes working with the computerized radios that are required to control them. And the cost of a modern composite sailplane with a computer radio runs three to six times higher than a same-size wooden plane with a 4-channel radio.

Now, it seems simpler sailplanes are back in style. They're back in the news, and kits that were off the market are being produced again. The number of flying-club events staged for balsa birds is escalating.

THE R/E/S TREND

What explains the diverging path from the decade-long mainstream trend toward increasingly sophisticated, immensely strong, six-servo sailplanes that dominated club, regional and national contests? What's the appeal of the open-bay wing construction, slow-flying, balsa ships? Cost is a factor, as is the building skill required. Aesthetic appeal also may be a factor. Ease of control undoubtedly figures in, especially for those of us who don't have lightning reflexes and hawk eyes.

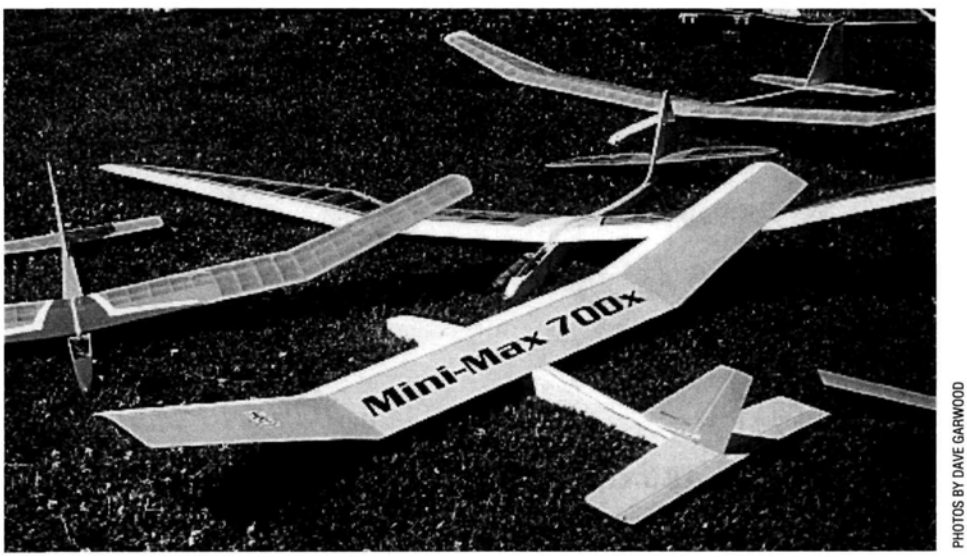
Realize that the majesty of silent flight, the triumph over gravity with an unpowered machine that you built yourself from sticks and sheeting, works just as well with the older, simpler designs as with newer, more sophisticated designs. Although wooden ships don't fly as fast or range as far in search of lift, they go up in lift even better than the composite planes because they are lighter. Many pilots find it easier to hold a steady thermal turn with a polyhedral wing than with an aileron wing. The Gentle Lady and its sisters have a lower sink rate than the Falcon 880 and its brothers.

AN R/E/S CONTEST

This past season, I built a Whyte Wings* Olympic II and flew it in an R/E/S run by the Charles River Radio Controllers. I had

A competitor launches an open-class Dave Thornburg Bird of Time.

Bent-wing sailplanes seen in the paddock at the CRRC Sudbury, MA, R/E/S contest included (left to right): Gentle Lady, Minimax 700, Bird of Time and Olympic II.



PHOTOS BY DAVE GARWOOD

a great time. Traveling with me was my new flying buddy, Wayne Rigby. Still in his first season of R/C soaring, this was his first contest, and I think he had an even better time than I did while flying an NSP 2-meter Kestrel, his first R/C airplane. Wayne couldn't wipe the grin off his face all day.

Twenty-three fliers from five states came to the Davis Farm in Sudbury, MA, to fly in the lowest-pressure competition event I've been to in 10 years. We saw Aquilas, Birds of Time, Gentle Ladies, Kestrels, Minimax* 700s, Olympic IIs, Paragons, Spirits and some own-design R/E/S planes.

It was a well-run affair blessed by fine flying weather and included a barbecue lunch served by the host club. We flew six rounds, and contest director Les Gerhardt's after-action report noted no wings broken on launch, no winch-line breaks, no lost airplanes, no off-field landings, no planes in the trees or water hazards and no protests or arguments. Everyone had a good time.

At the contest, I asked several people why the trend toward simple sailplanes was so strong. Here's what they said:

• "The low-cost planes, the low-cost radios, and the easy-to-fly planes are an enticement to beginning R/C pilots." —Dick Williamson, CRRC president, Lexington, MA.

• "We have a lot of fun. One big advantage is they get newcomers flying at contests." —Les Gerhardt, Acton, MA.

• "You can have competition without the complexity. You can have fun with low tech. There is more pilot-to-pilot, rather than plane-to-plane competition." —Steve Savoie, Bennington, VT.

• "These planes are easier to fly and they fly great. The thermal performance is there." —Wayne Rigby, Clifton Park, NY.

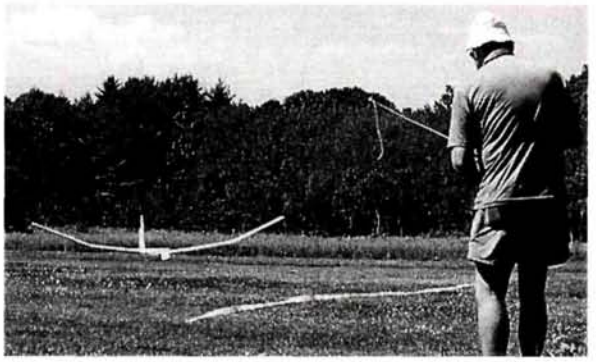
• "You can put the plane together in 10 minutes from spare parts." —Helmet Lelke, Southboro, MA.

• "The success of the flight depends more on your ability to work the sticks and less on having the 'right' plane or punching numbers into the radio." —Pete Young, Cambridge, MA.

• "Polyhedral planes turn better than aileron planes. Once you get into the thermal, you're set." —Dave Walter, Hudson, MA.

• "We're too old and tired to fly anything faster." —Fritz Bein, Boston, MA.

I'm happy to see the R/E/S trend grow. It's an alternative to high-tech soaring, sets out a welcome mat to newcomers and provides another arena for fun and fellowship among soar guys who like to compete.



Helmet Lelke guides his own-design R/E/S sailplane onto the landing spot.

If you intend to compete with your "Back to the Future" sailplane, be sure to check with contest organizers about construction modifications for a sailplane in an R/E/S or nostalgia event. For instance, the provisional AMA/LSF Nats rules allow changes to improve the strength or safety of a plane, such as substituting stronger building materials, but do not allow changes to the airfoil or wing planform. The R/E/S rules are less stringent and allow gliders designed in the past or present, but do not allow flaps or ailerons.

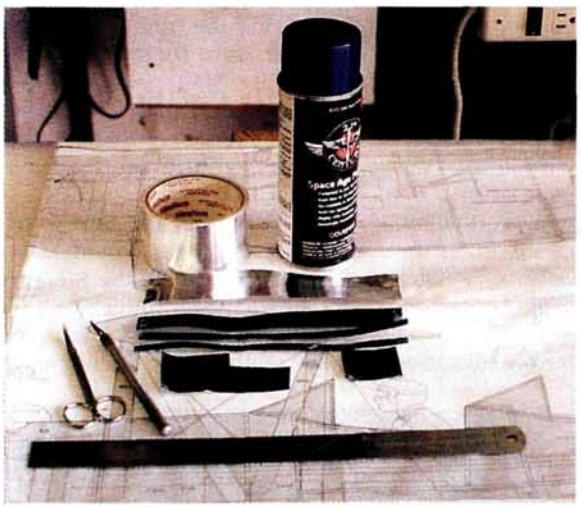
**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ✦

Frame Plastic Windshields

by Frederick Pope

A fast, easy detail that looks great

MY ROYAL STEARMAN S2N kit came complete with punch-out-and-fold acetate windshields, and I was looking for a way to make frames for them. In my vast collection of leftover good "stuff," I had half a roll of adhesive-backed, 2-inch no. 322 Nashua Duct Foil (available at Home Depot for $5.95 for a 50-yard roll). This has a finely textured finish to which paint adheres well without primer, and only gentle pressure is needed to make the adhesive stick.



Materials and tools for simple windshield frames: a roll of Nashua no. 322 Duct Foil, fuelproof spray paint, sharp pointed scissors, no. 11 hobby knife and metal straight-edge. With the paper backing still in place, painted foil is cut into strips 1mm wider than twice the desired windshield frame width.

I cut three, 8-inch pieces off the roll—one extra for experiments—and spray-painted them when I painted the engine cowl with Coverite* 21st Century High Gloss fuelproof paint to match the Coverite fuselage fabric color.

When ready to work on the 3mm-wide windshield frames, I discovered that I had to allow one extra millimeter for the thickness of the acetate and the foil fold. A no. 11 hobby knife used with a metal straight-edge made crisp straight lines through the painted foil and its paper backing. I cut four, 7mm-wide strips, peeled the paper off the adhesive backing as each strip was needed, centered the strip exactly on the acetate's edge and folded the foil over onto each side

Frame footings are cut to match the curves of the bottoms of the front and side windshield frames for this experimental unpainted windshield. It's best not to make illustrative creases in the footings until the backing has been taken off and the footings have been attached to the bottom windshield frames and fuselage.

The paper backing has been partly pulled away from the frame strip on which the bottom edge of the acetate windshield is exactly centered.

After the backing has been completely removed, the strip is partly folded onto the acetate windshield and is then mitered with scissors to fit exactly before the fold is completed.

with my fingers. The result was a strongly adherent frame painted inside and out with no aluminum showing. The bottom edges of the Stearman's windshields are curved to fit the fuselage, and the folded foil followed the curves exactly.

For the vertical front windshield frames, I used a 6mm-wide strip of foil on the outside and a 5.5mm strip on the inside, again with an exact match from inside to out. I found a single strip all the way around the top too cumbersome to fold and too difficult to miter with a pair of sharp pointed scissors, but mitering each panel piece to fit before pressing it down was easy.

Next, I tack-glued the two front and rear bottom corners of the windshield frames to the fuselage with a drop of thin CA. I made frame footings by cutting curved strips to match the bottom frame edges (with scissors) and applied these strips around the junction of the frames and the fuselage. Then I touched up any aluminum that showed at the mitered corners with a paintbrush dipped in Coverite spray paint sprayed into the can cover.

Total time spent from start to finish was about an hour.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

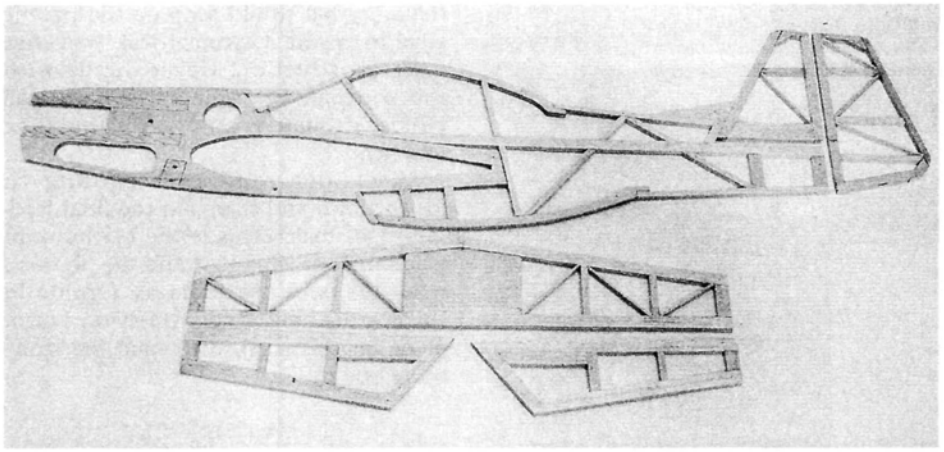
EZ build sport aerobat

TOWER HOBBIES

Fun 51

by Bob Hastings

I LOVE THE COMPETITION and camaraderie of a good, old-fashioned fun fly. This unique facet of R/C flying blends precise flying against the clock with pilots who are more interested in having a good time than winning at all costs. After 11 years of weekend jaunts from Alabama to Ontario, I've seen it all—and flown most of them. Unless you're competing in the National Competition Fun-Fly Association (an AMA-recognized organization for timed aerobatic maneuvers), a purpose-built, pod-and-boom "stick" is not the end-all plane to have in your arsenal—especially if the events require high speed, spins, bomb drops, or balloon busting.



The die-cut parts are flawless, and assembly is straightforward over wax-paper-covered plans.

SPECIFICATIONS

Model: Fun-51

Manufacturer: Tower Hobbies

Type: profile/sport/fun-fly aerobatic aircraft

Wingspan: 44 in.

Airfoil: symmetrical

Weight: 4 lb., 1 oz.

Wing loading: 14.95 oz./sq. ft.

Overall length: 34.5 in.

Radio: 4-channel with five servos

Engine rec.: .35 to .51

Engine used: O.S. .46 SF-ABC

Propeller used: APC 12x5

List price: $59.95

Features: easy-to-build kit with profile scale looks; light and durable balsa/ply construction; Duraluminum landing gear; rolled, full-size plans; high-quality hardware.

Comments: the Fun-51 is a fantastic value that is simple and quick to build, maneuverable in flight and a great venture into kit building from the world of ARFs.

Hits

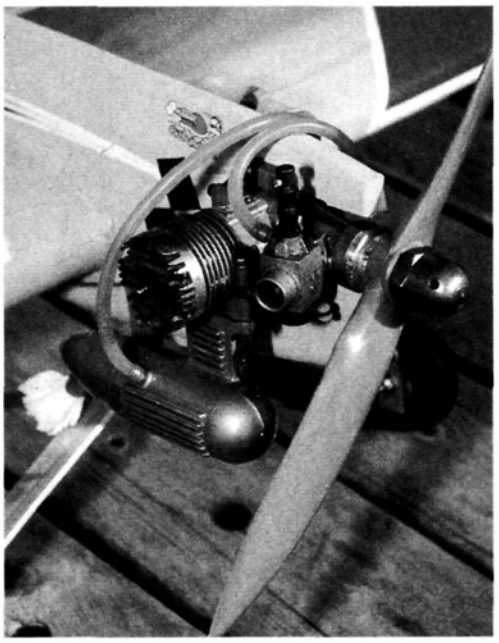
- Fantastic die-cutting and wood selection.
- Wide speed envelope with crawl speed landings.
- Unique appearance.
- Superior stunts without sacrificing stability.

Misses

- What, no stickers?

What seems to be coming into vogue? Profile aircraft! Like their control-line cousins, they have barn-door-size control surfaces and close coupling, but they don't have speed limitations, and they look like airplanes!

Behold the Tower Hobbies* Fun-51. It's easy to construct, and it was designed to fly as mild or wild as you prefer, depending on your experience, radio gear and setup. The Fun-51 is not a competition-specific airplane; it's a maneuverable, sport, hot-dogging rig.



An O.S. .46 engine provided more than enough power; a piped .32 or a .40 would also be a good match to the Fun-51.

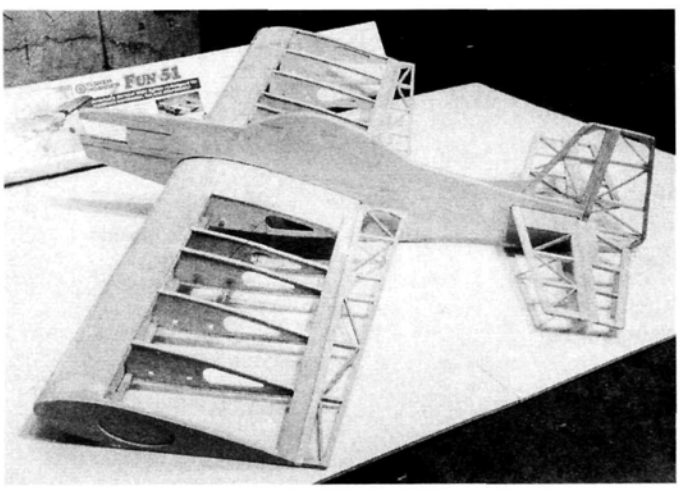
FUSELAGE CONSTRUCTION

You don't need to be a rocket scientist to build this kit. It's an excellent first venture into kits from the land of ARFs and not much more time-consuming—just cut to the marks, study the detailed drawings and follow the instructions. Although the structure will be sheeted, don't let that be an excuse for shoddy work. Remember, the quality goes in before the covering goes on. Organize your stick balsa, separating the various sizes and grades (stiffer grades for flying surfaces where strength is paramount; softer grades for the fuselage because it will be strengthened by the sheeting). Make absolutely certain that you're building on a flat surface! Great tracking is the jewel of the profile design; you're essentially flying a big vertical fin, so it must be straight. You've been warned.

Begin with the die-cut components. They're flawlessly manufactured without any hint of crushing. The drawings in the instruction manual are very detailed, and be sure to follow the instructions in order.

Start building the stick structure directly over your wax-paper-covered plans. Spray 77 adhesive is handy to tack down the wax paper. Using the drawings and plans, assembly is straightforward. Pay attention to the seam lines for the final sheeting process. Cut away the overhangs on the fuselage sheeting that don't look like a P-51. Next, use your plywood engine mounts as a template to trim the sheeting area where they'll be positioned. Following the addition of the engine-mount doublers, give the structure a final sanding.

After making the requisite airplane noises and flying the fuse around the workshop, test-fit one of the wing ribs to see if you'll need to massage the opening in the fuselage. Now is the time to find out, as you'll be sliding the completed wing through here.



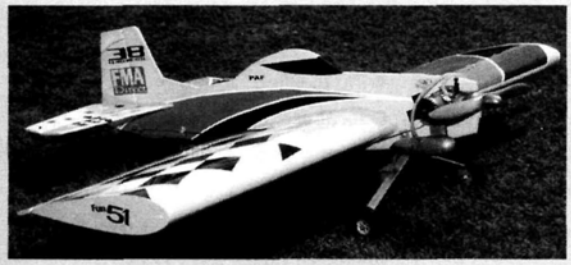
All framed up and ready for covering, the Fun-51 already looks as though it should be in the air.

BUILDING THE FLYING SURFACES

Once again, you're building over the plans. No engineering degree is required; however, now you don't have the luxury of a sheeted

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING
My O.S. .46 was idling smoothly, and the Fun-51 looked ready to pounce! Gently ease the throttle stick forward, right? Nope; pour the coals to it, and



let's see what it's got. A 15-foot rollout assisted by a dose of right rudder had the ship screaming along. It had more than enough power and just exploded into the air (a piped .32 or even a .40FX would also have been good choices).

After the .46 sucked the 4-ounce tank dry, my first return was dead-stick. The model glides beautifully, and that "baseball bat" blunt leading edge does a good job of slowing things down. A slight nose-down approach, and all was completely predictable. Later landings under power proved incident free and at a strolling pace with a slight headwind.

• LOW-SPEED PERFORMANCE
The plane's enormous airfoil and generous wing area contribute to extremely predictable low-speed performance. When forced into a nose-high stall condition, the plane just noses over and droops until the wing starts flying again. When in this mush mode, don't attempt to use anything but rudder input. You've used up your elevator, and aileron input will only further stall the wingtip.

• HIGH-SPEED PERFORMANCE
The Fun-51 flies with authority and has no tendency toward flutter, even with the throws at their maximum. Its low-speed maneuverability is a trade-off with high-speed sensitivity. Know the location of the dual-rate switch, in case your thumbs aren't up to the challenge.

• AEROBATICS
And to think this much fun could come out of a box! Roll rate is about 4 per second in either direction, plus more axial than I've had on most planes. Loops are tight and straight, though I did initially find I had programmed too much flap, creating a corkscrew effect. If you use flaperons, start with about half the flap travel compared to the elevator.

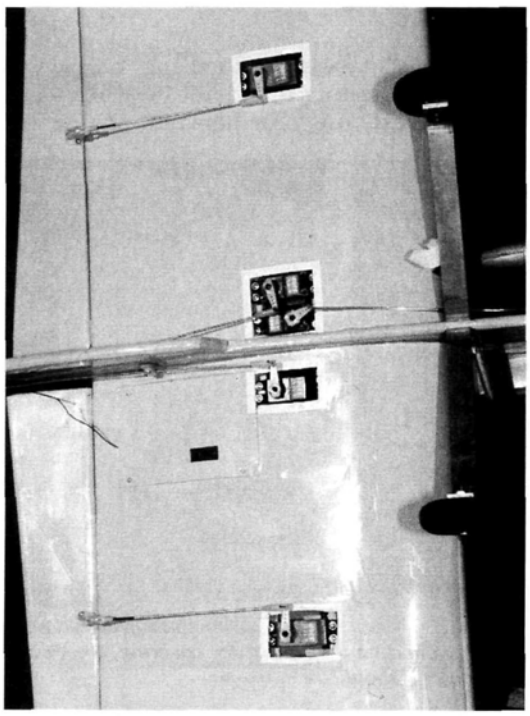
You *have* to nose-up-hover this thing. Make a regular stall-turn entry with a power-off climb, but at the moment you'd normally be slamming the rudder over, go to about ¾ throttle. Sustained hover can be achieved with only a bit of practice. After you've mastered it, you can perform this on the deck (you'll look like a hero).

end product. For the last time, don't force a bad joint. Further, because the Fun-51 draws attention in the air, aesthetics will count when the gang is scrutinizing your newborn in the pits.

You need to create the 44-inch wing spars and sheeting by splicing the 36-inch stock supplied in the kit. When you lay the balsa into place, don't put all of the splices on the same side of the wing or you'll sacrifice strength.

The wing is assembled upside-down on the building board. It's made out of different numbered ribs: four no. 1s make up the center section; 10 no. 2s make up the outboard panels and a pair of plywood wingtip plates.

The next step initially confused me until I realized that I was only creating a jig that would prop up the trailing edge to ensure a symmetrical, warp-free wing construction. Cover the jig with wax paper and start slinging ribs. A small builder's square is an essential building tool here.



FMA servos control throttle, aileron, rudder and elevator. Control linkage is straightforward.

Sheet and capstrip according to instructions, and then add the final leading-edge stock. (This is the big hunk of wood in your wing jig.) Add the plywood wingtips, and use them as a guide in shaping the leading edge (I rely on a razor plane for this part), then sand the structure smooth.

FINAL ASSEMBLY

The first step in the instructions of final assembly documents how to set the wing in place and make certain it's straight. Draw the centerline on the wing's center section. Then mark a parallel line ¼ inch on either side. This will provide a straight reference with which to align the fuse to the wing. Tower recommends 3-minute epoxy here. It's a bit thicker and won't ooze all over the work table while you're staring at the clock. After it has cured, fill any gaps with 5-minute epoxy and microballoons.

After I sanded the joint, I sprayed LustreKote* yellow on it. It matches the final covering perfectly.

Now install your radio gear and engine. I used a Futaba* 8UAP transmitter and FMA* receiver and a pair of FMA 300 servos for throttle and rudder, 360s for ailerons and a 350 for elevator.

One clever addition to the engineering of the plane is a drilled hole on the CG to "hang" the airplane for all balancing. This pays off in flight performance.

Kudos to the folks at Tower for a simple, 16-point covering checklist that helps you get the most out of your covering time. I originally wanted to outfit the Fun-51 in military colors, but the more I looked at it, the more it reminded me of something out of the Reno Air Races. Two rolls of yellow MonoKote* covered the structure. Self-adhesive MonoKote trim sheet made quick work of the stripes and satisfied my overactive checkerboard glands.

FINAL THOUGHTS

It's amazing how quickly you can become emotionally attached to an airplane. If you're like me and rate your new creations by ease of construction and enjoyment in flying versus time and money invested, the Tower Fun-51 will be a worthy addition to your fleet. The Fun-51 is designed well, looks sinister and has performance that will taunt you into maneuvers that would do the "Baron" proud.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ✦

Cessna Model 195

PHOTOS BY LARRY MARSHALL

If you have a soft spot for tail-draggers, like the looks of a big radial engine, or want the simplicity of a one-piece, cantilevered wing without the hassle of lift struts, the Cessna 195 is sure to appeal. This is one airplane that just begs to be modeled.

With its large wing, clean lines and neatly cowled, powerful Jacobs radial, the Cessna 195 is a very efficient yet rugged aircraft that has become an American classic. Manufactured in anticipation of a postwar aviation boom that never quite materialized, the 195 continued in Cessna's tradition of high-wing monoplanes and combined the all-metal skin of a military craft with a luxurious interior. When it was marketed to business executives in 1947, the 195 was the Cadillac of four-place aircraft and featured chrome-vanadium, fixed landing gear, upholstered foam cushions and adjustable seats, cabin temperature adjustment and a large luggage compartment that was accessible from inside and outside the plane.

The plane has excellent climb performance—particularly useful for taking off from the small, dirt fields that prevailed in the '50s—and a comfortable cruising speed of more than 165mph. It also featured a high useful load and range of more than 700 miles.

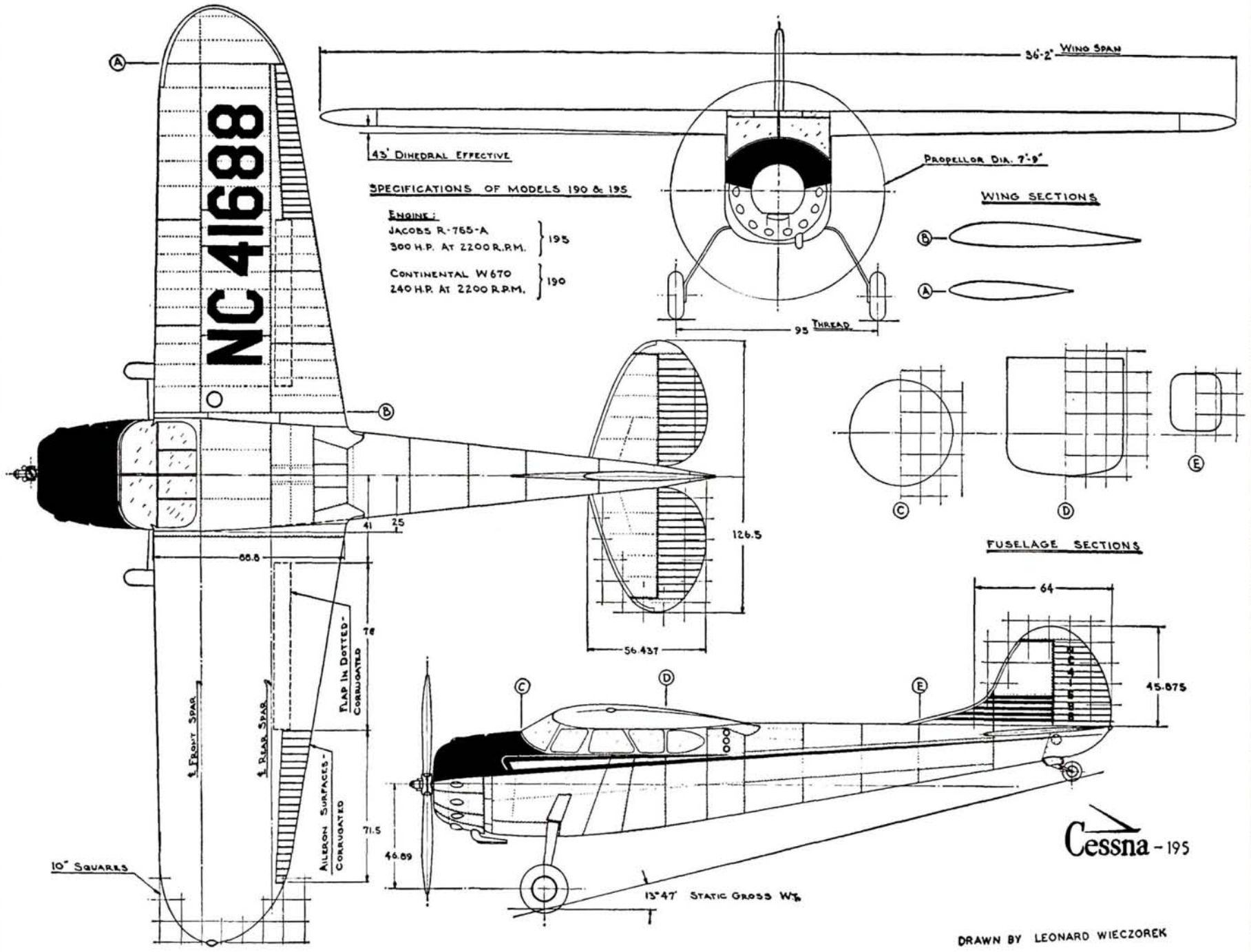
Like most civilian aircraft, Cessna 195s are found in many schemes, but those who prefer military colors can turn the 195 into the U.S. Air Force LC-126A, which was equipped with interchangeable wheel, float and ski landing gear for Arctic rescue work.

—Debra Sharp

These Cessna 195s at the Oshkosh, WI, AirVenture Fly In demonstrate only a few possible paint schemes.

SPECIFICATIONS

Name: Cessna 195
Wingspan: 36 ft., 2 in.
Chord: 84 in.
Length: 27 ft., 4 in.
Height: 7 ft., 2 in.
Weight: 2,030 lb. (empty), 3,350 lb. (loaded)
Maximum speed: more than 180mph
Engine: 7-cylinder, 300hp Jacobs radial


NC41688
36'-2" WING SPAN
43' DIHEDRAL EFFECTIVE
PROPELLOR DIA. 7'-9"
SPECIFICATIONS OF MODELS 190 & 195
ENGINE:
JACOBS R-765-A
300 H.P. AT 2200 R.P.M. } 195
CONTINENTAL W 670
240 H.P. AT 2200 R.P.M. } 190
WING SECTIONS
95 THREAD
126.5
56.437
41
25
88.8
78
71.5
46.89
FRONT SPAR
REAR SPAR
FLAP IN DOTTED - CORRUGATED
AILERON SURFACES - CORRUGATED
10" SQUARES
FUSELAGE SECTIONS
64
45.875
13"47' STATIC GROSS WT.
Cessna - 195
DRAWN BY LEONARD WIECZOREK

Shoestring

by Pat Tritle

THE YELLOW AND red Shoestring has always been one of my favorite airplanes and, over the years, I've built several free-flight and U-control Shoestrings, all of which were great fliers. A few years ago, I started thinking about a small R/C Shoestring, and the growing popularity of Speed 400 motors convinced me to forge ahead.

I designed this Shoestring so it could be built and flown by modelers with intermediate skills yet still represent the full-scale Shoestring in a legitimate fashion.

Speed 400 scale racer

The result is a very stable, reasonably fast, all sheet-balsa model that's a pure joy to fly! I've tried everything I can to make the airplane "snap" out of a turn and found that it just won't. Its stall is more of a "mush" while maintaining aileron control all the way down the speed range.

The model was designed around the 6V Speed 400 motor and is controlled by only elevator and aileron. Hand-launching is easy, as there is plenty of fuselage to hold. Landings are done 3-point, so the fixed tailwheel keeps a good straight line during the short rollout; if you're flying onto grass, just plop it in!

PHOTOS BY PAT TRITLE

Even though the model has a good roll rate, the aileron input isn't twitchy in the center at all. Even with the CG moved aft, the elevator never gets "goosey." When the CG was too far aft, the model just wouldn't come up on step. All in all, this is a good, solid, honest airplane that I recommend to anyone who's entering the wonderful world of little airplanes.

BUILDING THE FUSELAGE

As always with a model of this type, it must be built light! I built my prototype using hand-selected aircraft-grade balsa, but using contest-grade wood will only help if you're really serious about building a lightweight airframe.

Start by cutting and shaping the vertical and horizontal stabs. The elevator will be hinged with Ultracote after covering.

Build the fuselage next. Start by cutting the fuselage sides and doublers, following the triangular marks on the plan, then cut the formers and former doublers, assembling them as you go. Glue the doublers to the fuselage sides and add the 1/4-inch balsa tri-stock and 1/8-inch-square balsa lower longerons.

Glue formers F-3 and F-4 to the right-hand fuselage side, using a triangle to align them. Now glue the left-hand side of the fuse to the formers. Glue the tail post pieces together and add formers F1, F2, F5 and F6 and the 1/16x1/8-inch crosspieces. Now you can add the 1/8-inch-square top stringer, 1/8-inch balsa bottom sheeting and 1/4-inch balsa chin block.

Before adding the top sheeting, be sure to install the Sullivan* no. 507 pushrod tube. Now is a good time to shape the balsa tail-fairing blocks and add the lite-ply landing-gear plate and balsa triangle and lite-ply wing-bolt plate.

Using a Sig* 1/16x1x10-inch landing-gear blank, drill and shape the gear as shown on the plans. Drill and tap the plate for the 8-32 bolts and mount the gear. Now cut out, assemble and shape the wheel pants to complete the basic fuselage.

BUILDING THE WING

Building the wing really isn't difficult, but the dihedral is built into the bottom skin, so use the dihedral/washout jigs shown on the plans to ensure proper alignment.

Start by joining five, 1/16x3x32-inch balsa sheets. Cut out the lower skin to the size shown on the plan. The top one should be slightly oversize to compensate for the curvature. Cut the ribs out of the scraps. Using the plans, mark the position of all the ribs and aileron spars. Using a sanding block, taper the top of the lower trailing edge (TE) to the contour shown on the rib templates. Now, carefully score the skin under ribs R1, and gently crack it to form the dihedral.

Cut the 1/4-inch balsa leading edge (LE) and glue it into place. Cut the 1/16-inch balsa R5 and R6 tip doublers and glue them into place. Next add ribs R2 and R4 and glue the 1/8-inch balsa hinge spars into place followed by R3 and the aileron ribs.

Build up a left and right washout jig using the patterns on the plan, and position them under rib R4 and align them to the TE. Using scrap balsa, shim the LE so it doesn't bow when the upper skin goes on. Now glue the R1 ribs into place. Add the balsa filler in the center section at the LE and TE.

Slip the 3/32-inch aluminum tubes over 1/16-inch music wire, and bend the torque rods to shape. Cut down Du-Bro* 2-56 threaded couplers and solder them to the torque rods. Spend a little time fitting the torque rods to ensure smooth, non-binding operation before you glue them into place.

Locate the outlet slots for the torque rods and cut them into the upper skin. Carefully align and test-fit the skin to the wing. When you're sure that everything fits properly, lay the skin aside while you use a pin to poke holes around the aileron outline through the bottom skin. This will make cutting the aileron out of the wing a lot easier later.

Finally, inspect the wing assembly one more time before gluing the upper skin into place with medium CA. After it has dried, remove the wing from the board and sand it to shape.

Carefully cut the ailerons, and shape them for hinging.

ATTACHING THE WING

Find and mark the centerline of the wing and align it to the fuselage. Using a piece of 1/8-o.d. brass tube, reach into the front opening of the fuselage and mark the LE through the dowel hole in F-3. Remove the wing, drill an 1/8-inch hole on the mark and glue the dowel into place. Glue the plywood blind-nut plate to the wing, and drill an 1/8-inch hole through the wing. Reinstall the wing on the fuselage. With the wing properly aligned, drill a 3/32-inch hole in the bolt plate. Remove the wing again and, with a piece of music wire in the hole in the hold-down plate, punch through the fuselage bottom. Open the hole to 1/4 inch and line it up with the bolt plate using a paper tube.

SPECIFICATIONS

Model: Shoestring

Type: electric sport-scale

Wingspan: 30.5 in.

Length: 28.5 in.

Wing area: 165 sq. in.

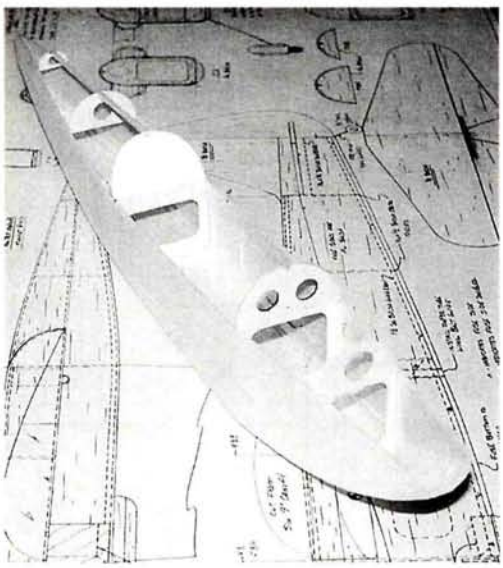
Flying weight: 16 to 18 oz.

No. of channels req'd: 3 (throttle, elevator and aileron)

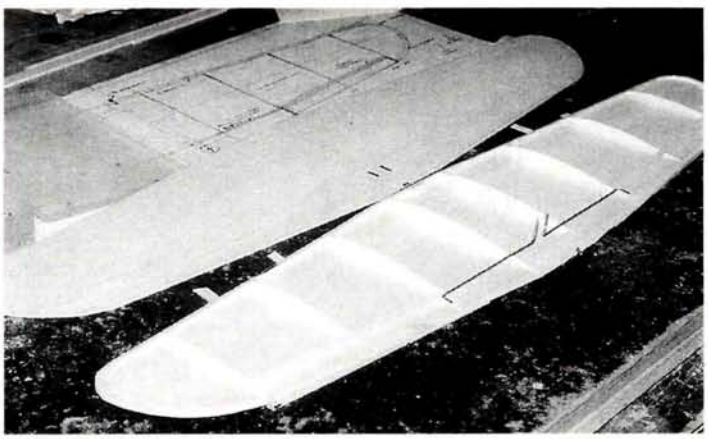
Power: 6V Speed 400 motor with Sprite XLR BEC controller, 500AR 7-cell battery and Aeronaut 6.5x4 prop

Features: this Speed 400 model is designed to be built and flown by modelers with intermediate skills, yet still represent the full-scale Shoestring in a legitimate fashion. It is very stable, reasonably fast and a joy to fly.

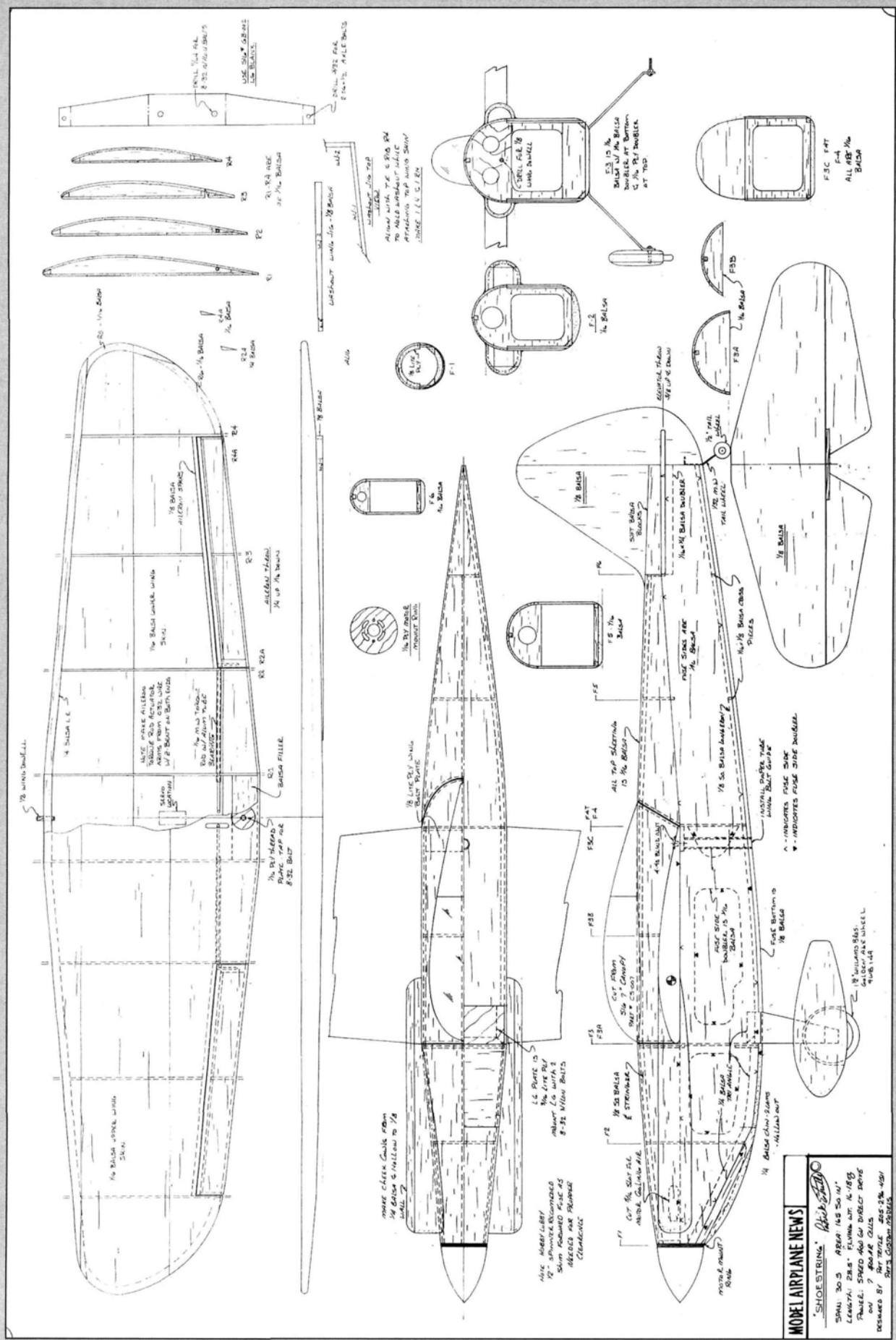
Now reinstall the wing, push the 3/4-inch-long 4-40 bolt through the wing, add a T-nut and turn it until it's just snug.



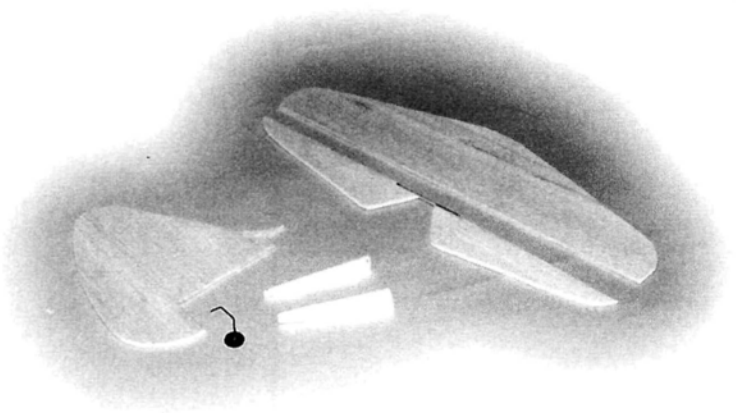
The Shoestring fuselage is fairly easy to assemble.



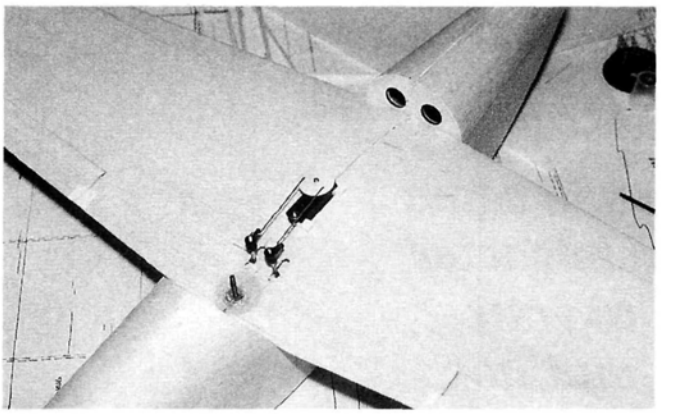
The dihedral is built into the bottom wing skin by using the jigs shown on the plans. The ailerons are controlled via the torque tubes; be sure they fit well before you glue them into place.



FSP 05991 **TO ORDER THE FULL-SIZE PLAN, SEE PAGE 120 OR CALL (800) 537-5847**



The tail surfaces are sheet balsa. The elevator is hinged with Ultracote after the tail pieces have been covered.



The aileron servo is attached to the underside of the Shoestring wing, which is attached to the fuselage with a 3/4-inch-long 4-40 bolt and a T-nut.

Note that the T-nut won't be aligned with the upper surface of the wing. Use a dab of 5-minute epoxy to glue the nut and fill the gaps.

Now it's time to install the aileron servo and linkage. Make sure that the aileron installation is right before you close the model up, as it's inaccessible on the finished model. I'm not crazy about doing it this way, but the torque rods on the bottom won't allow adequate battery clearance.

When you're satisfied with the installation, glue formers F3A, B and C into place along with the 1/8-inch-square centerline stringer. Remove the wing from the fuselage and sheet the center section with 1/16-inch sheet.

Build up the cheek cowls from 1/4-inch-thick light balsa, and rough-shape and hollow them before you glue them into place. I used Micro Fill to feather everything after assembly.

INSTALLING THE MOTOR

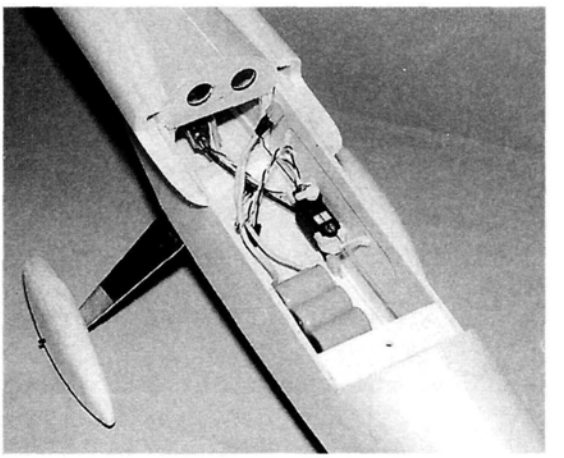
Cut the motor mount out of 1/16-inch-thick ply and glue it to the front of the fuselage. The spinner you use will determine how thick a balsa ring you'll need to glue to the front end to fair it in. Again, use Micro Fill to feather it all in.

My prototype was powered with a 6V Speed 400 motor and a Sprite* XLR BEC controller. The system was hard-wired using a Deans* four-pin connector for the battery. An S-80 servo was mounted to the right-hand fuselage side; the receiver was mounted on the other side. As always, I removed the case from the receiver for an additional 1/2-ounce weight savings. Finally, install the elevator horn and Z-bend the 0.025 music-wire pushrod at the servo end and clip it extra long at the back end.

COVERING AND FINAL ASSEMBLY

Prep-sand the airframe to remove any bumps or boo-boos. I used EconoKote* to cover and trim my model. The markings are decals from the Carl Goldberg* 42-inch-span Shoestring U-control kit. The canopy, landing gear and wheel pants were painted with dope.

With all covering and trim completed, align and glue the tail section into place—don't forget the tailwheel! Trim, fit and install the Sig 7-inch canopy, install the wheels on the 4-40 bolt axles, and epoxy the wheel pants to the gear. Bolt the gear to the fuselage with two 8-32 nylon bolts.



Use the battery as ballast to properly adjust the CG. The battery is held in place with Velcro®.

Using the battery location for ballast, balance the model as shown on the plans. Use a 2-inch strip of Velcro®-brand fastener to hold the battery in place. I used a 500AR 7-cell battery in a three over four stack.

FLYING THE SHOESTRING

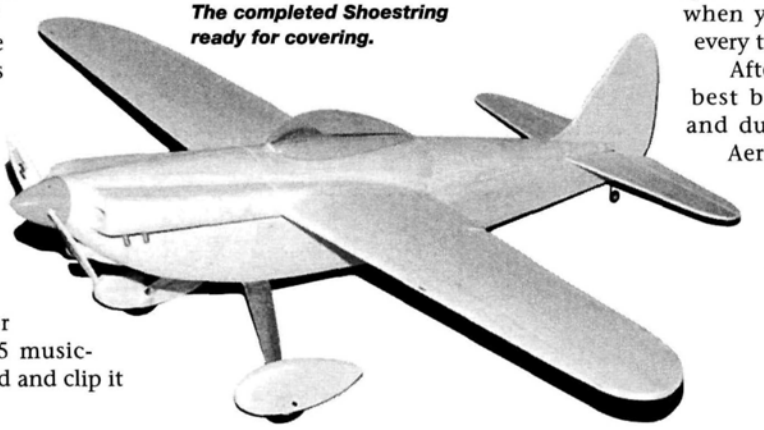
Before your first launch, check the control throws. The elevator should be around 5/16, the aileron around 3/16.

Install a fresh battery, run the motor up to full throttle and briskly hand-launch the model. It will lose about 3 feet of altitude while building speed but will soon settle into a nice groove. The best-looking turns are banked about 45 degrees, but knife-edge turns are great using just enough elevator to maintain altitude. Rolls, loops and stall turns are great, even without a rudder. To get the stall turn, just pull up gently into the vertical line. As the airplane slows down, torque will take over and pull the nose around. As the plane brakes over the top, reduce the throttle and the nose will fall right through. It takes a little practice, but when you get it figured out, it works every time.

After much testing, I've found the best balance between performance and duration was achieved using an Aeronaut* 6.5x4 prop. Static current draw is 13.2 amps for about 110 watts on 7 cells. Duration is around 3 1/2 to 4 minutes using the 500AR cells.

Good luck and good racing.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

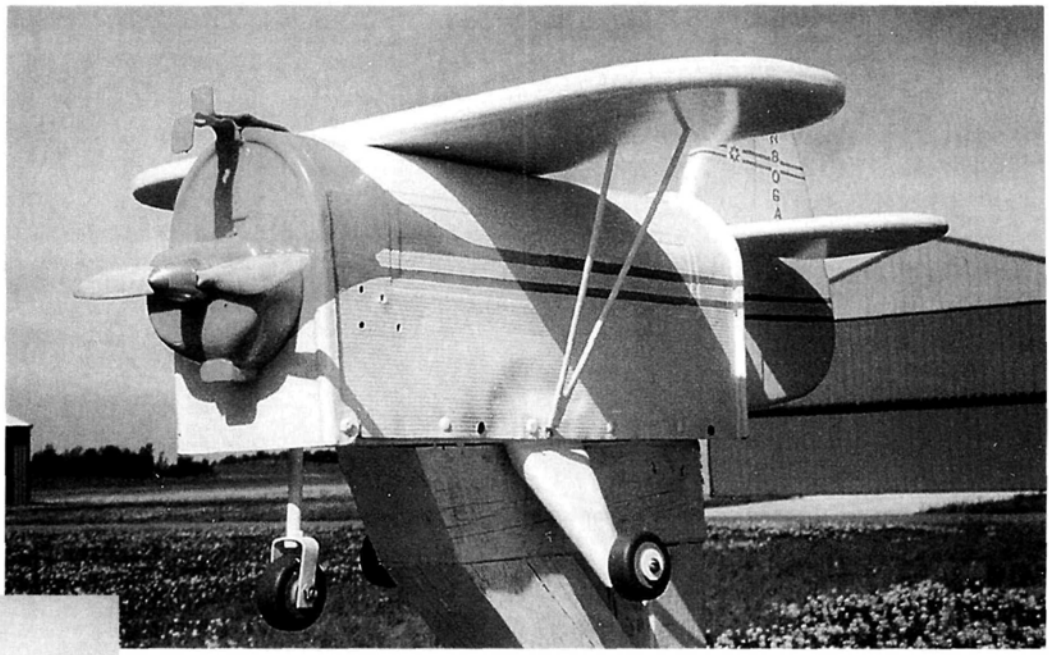


The completed Shoestring ready for covering.

MODEL AIRPLANE NEWS
HOW TO

Add some character to your mailbox

by Don Sektnan



Airmail modeling

THE CUSTOMIZED MAILBOXES you see in mail-order catalogs and hardware stores aren't cheap, and if you're lucky enough to find an airplane design, it may not appeal to you. In this article, I'll show you how to turn your mailbox into a reasonable representation of your favorite airplane. My mailbox, which looks like my full-size 1951 Piper Tri-Pacer, demonstrates my love of airplanes and my sense of humor.

GETTING STARTED

Because the mailbox will be outside, I used pieces of ¾-inch-thick redwood. If you don't have 1x10-inch wood, glue together two pieces of 1x6-inch (or 1x4 and 1x6) stock with wooden dowels or biscuits. Don't use plywood layers; they will separate and have to be replaced.

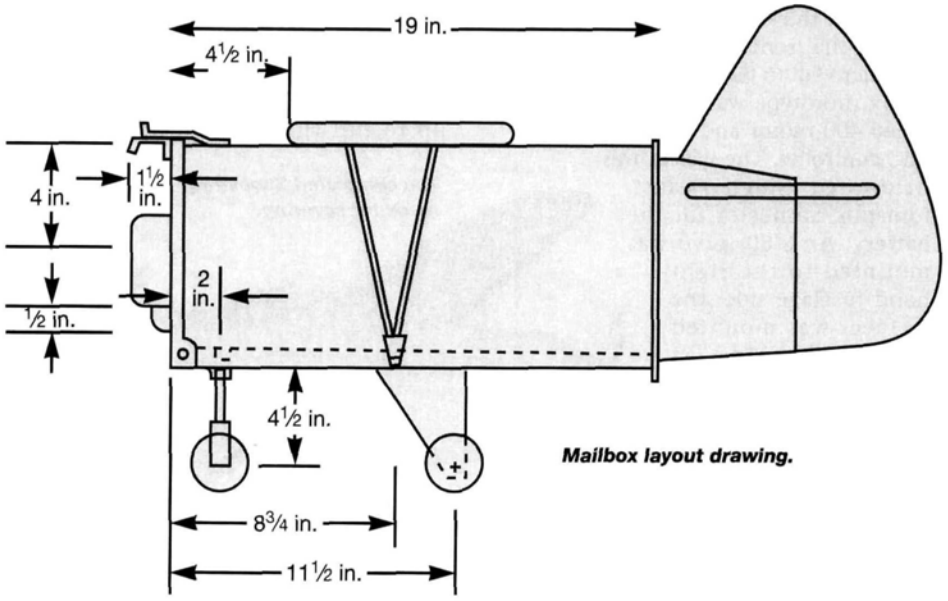
First draw a 1-inch-square pattern on lightweight cardboard. Using your drawings, make the various marking or locater points on the appropriate squares on the cardboard. Now connect the dots! I like to use various sizes of plastic lids or a French curve to draw the curved lines.

Cut out the patterns and position them on the wood. You don't have to use high-grade wood; keep the cost down by carefully positioning the templates around any knots. When you position the templates, be sure to follow the grain pattern shown on the drawings. You only need to draw half of the wing and elevator templates because you can flip over the patterns and trace the other half. If you can't fit the entire rudder (or elevator) pattern on the wood, then make it in two pieces and join them with wooden dowels or biscuits. The joint doesn't have to be absolutely flat; if it's a little out of line, it will simulate the hinge line between the surfaces.

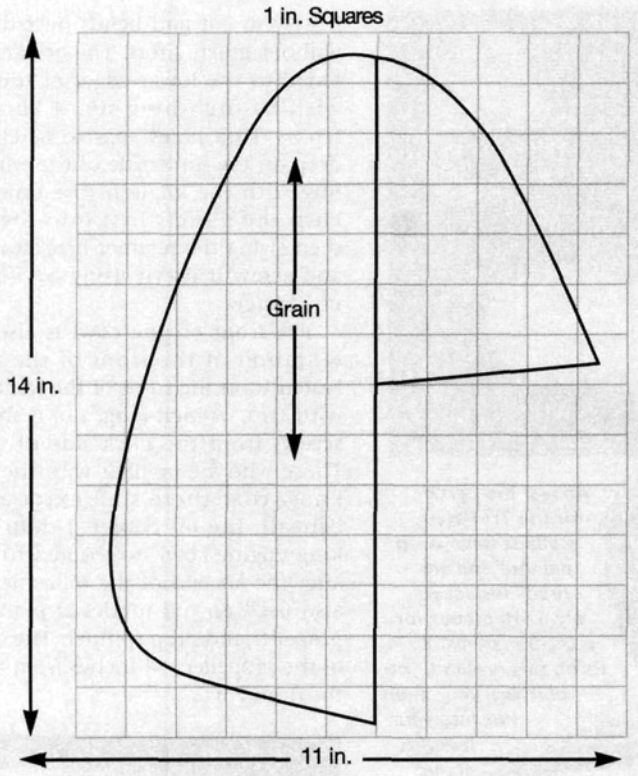
CUTTING THE PARTS

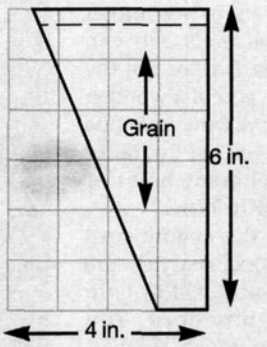
I used my band saw to cut out the various pieces. To make the rounded edges on the appropriate pieces, I used a ⅜-inch roundover bit in a router mounted in a simple router table. (You can make the rounded edges freehand with just a router. If you don't have a router, use a wood plane.) Smooth the edges with 60-grit sandpaper—especially the ends of the cross-grain—and finish with 220 grit.

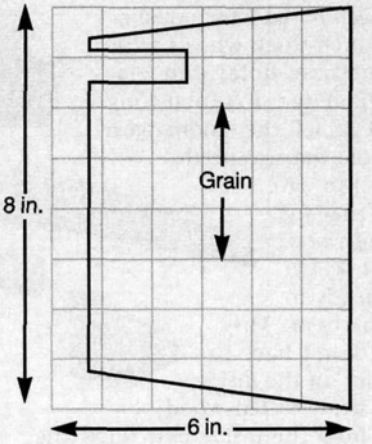
When you cut the slots in the aft fuselage and elevator, measure the thickness of the wood and make the slots a tight fit. To fasten the elevator into the aft fuselage section, drill holes from the top side of the fuselage and use long wood screws or push wooden dowels into the holes. Apply glue to the holes and to where the fuselage and elevator meet. If you carefully lay out the holes on the top edge of the fuselage, you will also be able to fasten the forward

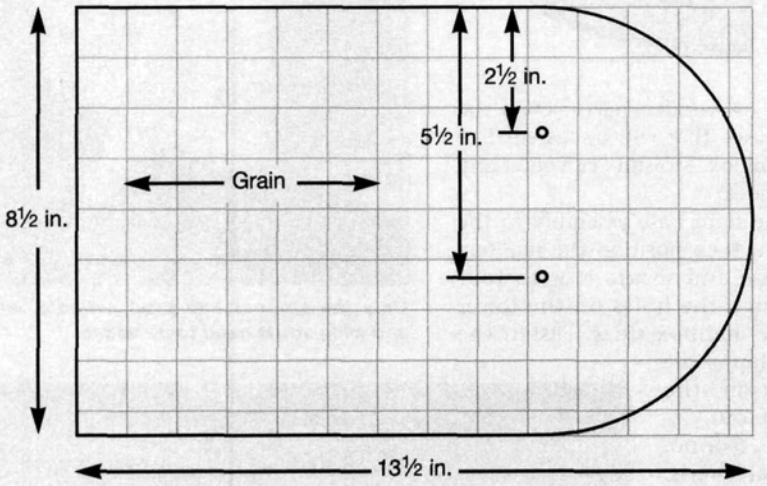


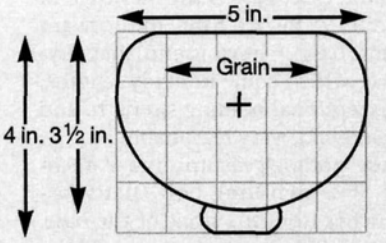
Mailbox layout drawing.

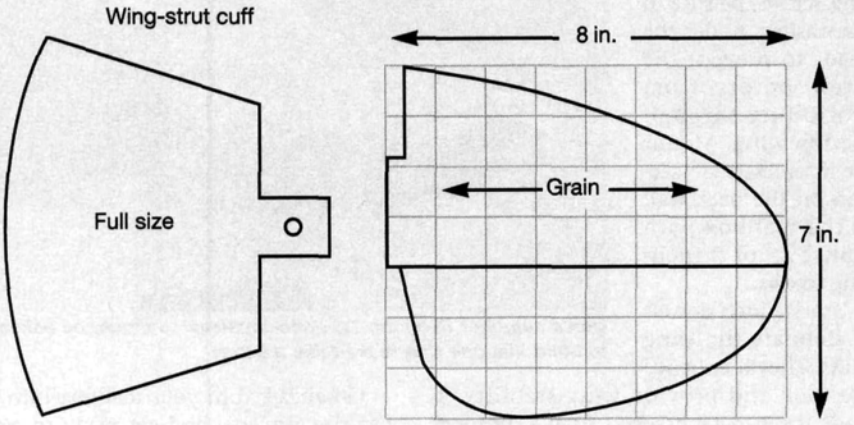

1 in. Squares
Grain
14 in.
11 in.

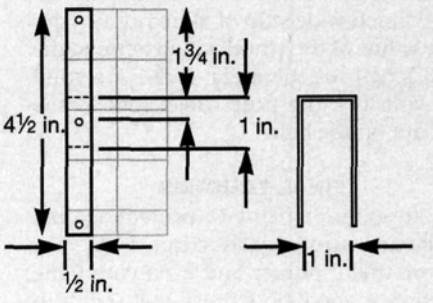

Grain
6 in.
4 in.


Grain
8 in.
6 in.


2½ in.
5½ in.
Grain
8½ in.
13½ in.

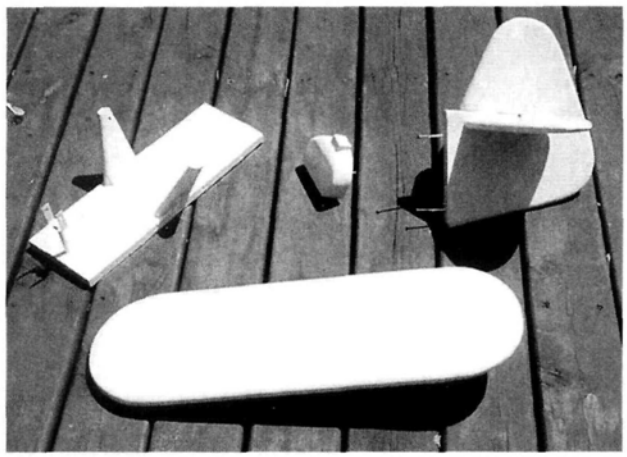

5 in.
Grain
4 in.
3½ in.

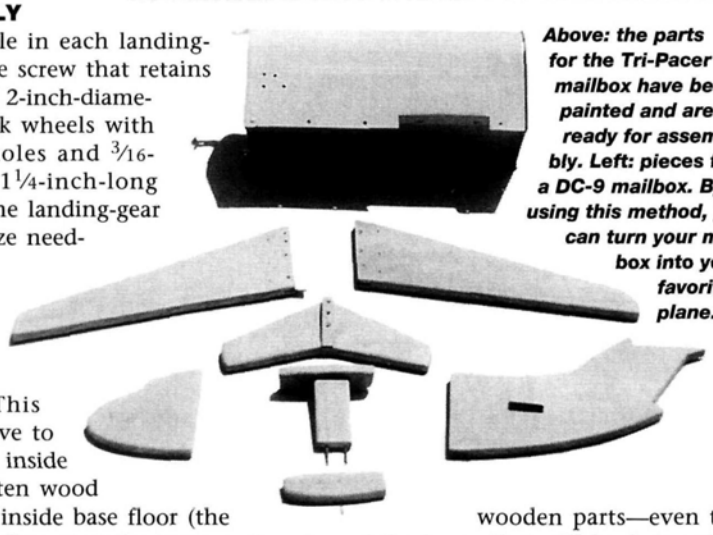

Wing-strut cuff
Full size
8 in.
Grain
7 in.


1¾ in.
4½ in.
1 in.
½ in.
1 in.

vertical rudder fin to the fuselage by using longer wooden dowels between the pieces. Drill or slot the rudder to accept a wooden dowel or biscuit and glue it to the vertical fin. Make the attachment holes or slots slightly loose.

Carve the engine cowl out of wood, making sure the back of it will fit onto the mailbox door. You could also use an old plastic-model cowl that fits.





Above: the parts for the Tri-Pacer mailbox have been painted and are ready for assembly. Left: pieces for a DC-9 mailbox. By using this method, you can turn your mailbox into your favorite plane.

ASSEMBLY

Drill an axle hole in each landing-gear strut for the screw that retains the wheel. I used 2-inch-diameter, ¾-inch-thick wheels with 3/16-inch axle holes and 3/16-inch-diameter, 1¼-inch-long bolts. I drilled the landing-gear strut hole the size needed to tap the bolt threads into the wood, then I CA'd the threads to harden them. This way, I didn't have to put a nut on the inside of the strut. Fasten wood screws from the inside base floor (the top of which will fit against the bottom of the mailbox) into the landing struts. Be sure to make a right and left strut, and note that the rear edges of the struts are square to the base. Fasten the rear edge of each strut 11½ inches from the forward edge of the base. I have found that drywall screws, which come in many lengths, provide exceptional holding strength, and the cost per box is very reasonable.

The nose landing-gear strut is a ¼-inch-diameter, 4½-inch-long bolt that's fastened 2 inches from the front of the base. Recess the bolt head flush and drill the hole undersize to make it a tight fit. Cut a 2¼-inch piece of aluminum or copper tube and slip it over the bolt. Screw a nut onto the bolt to hold the tube tightly against the mailbox. Make a nose-wheel fork out of a ½-inch-wide strip of aluminum or tin. (The width of the wheel will determine the total length of the metal fork.) A second nut will lock the nose-wheel fork to the first nut on the bolt.

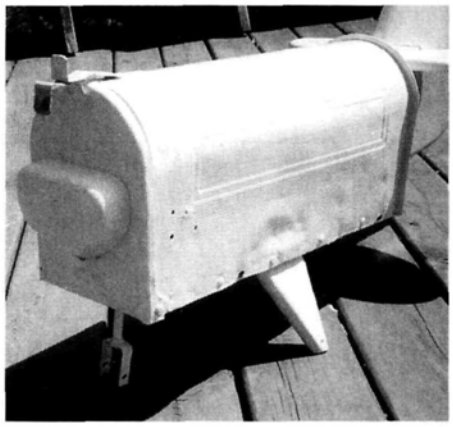
FINAL TOUCHES

Use an exterior paint to protect against moisture and weathering. I used a polyurethane primer and a polyurethane exterior. A good gloss finish will stand up better than a flat finish. Paint all the wooden parts—even the top of the base—that will be fastened to the metal mailbox. Moisture can enter any unprotected area.

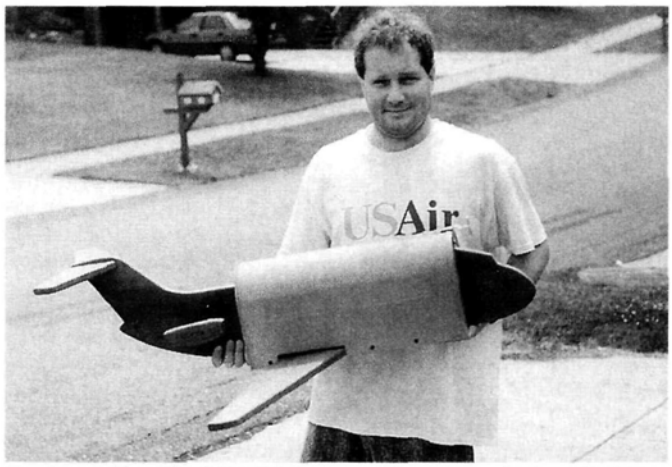
Mount the floor base assembly to the mailbox post, then position the mailbox over the base and secure it with four screws through the holes on the lower edges of the mailbox sides. Fasten the wing to the top of the mailbox from the inside using four, 5/8-inch-long no. 6 or no. 8 sheet-metal screws. If you use ¾-inch-long screws, be sure to use washers under the heads to prevent the screw points from protruding through the top wing. Mount the assembled tail section on the back wall of the mailbox with four, 1½- or 2-inch-long screws.

Use 3/16-inch dowels to simulate the wing struts. They'll enhance the look and provide wing stability. I made sheet-metal brackets from a tin food can to hold the struts to the mailbox. Tin is easy to cut and bends over the dowels without much effort. The brackets are fastened to the lower edges of the mailbox with ½-inch-long no. 4 sheet-metal screws. Drill holes approximately ½ inch deep on the underside of the wing and in line with the angle of the dowel struts. Push the dowels first into these holes, then swing the retainer bracket into place and screw it down using a ¾-inch-long no. 4 screw.

The front engine cowl is also a representation of the front of the airplane. Fasten it on the front of the mailbox door with two, ¾-inch-long, no. 6 sheet-metal screws from the back side of the door. Those who are familiar with the Tri-Pacer know that there's an extra air scoop beneath the oil cooler. I didn't want a long engine cowl, so I opted to stop just after the aft end of the oil-cooler bulge. I also used an old model airplane engine propeller and prop spinner. The centerline of the propeller is 4 inches from the top of the front cover.



Only the spinner and prop, wheels, wing and wing struts need to be added.



Don's neighbor liked the Tri-Pacer mailbox so much, he asked Don to build him one that looked like a DC-9.

Go ahead; turn your mailbox into your favorite airplane, and get ready to receive some "airmail!"

A scale model of Rutan's composite canard

by Greg Gimlick

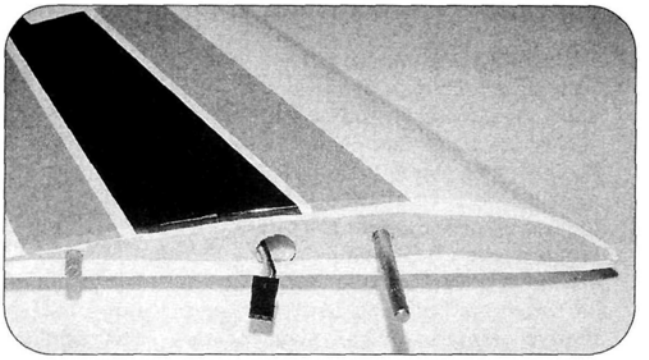
HOBBY LOBBY INTL.

Vari-EZE

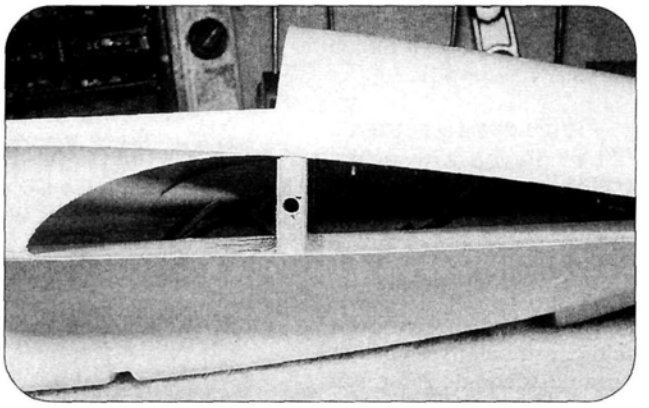
I'LL START by admitting that I like to show up at the flying field with something that's "a bit different," and if it's a scale model, all the better. If you enjoy such moments, too, then the Hobby Lobby* Vari-Eze may be the model that fills the bill. Designed in 1974 by Burt Rutan, the full-size plane has become one of the most popular home-built aircraft on the market and has a notable safety record.

I was particularly interested in this project for several reasons, not the least of which was that I wanted to disprove those who refer to canard designs as "canardly fly," but the main reasons are that the Vari-Eze is to scale and is one of the new kits from the Czech Republic. When I first received the kit, I was contacted by Jim Martin (Mr. Hobby Lobby), who told me about the power system he was using and asked whether I was interested in experimenting with a geared setup. This was an interesting proposition, as most manufacturers prefer reviewers to use the standard setup, and I couldn't help but take him up on it. The kit instructions recommend setups varying from 7-cell direct to 10-cell geared systems, and Jim didn't think there would be much difference in the way the model handled with the added weight.

The fiberglass fuselage is a beautifully gelcoated piece of work that needed only to be washed before painting. The wings are obechi-sheeted foam with predrilled holes for the servo wires and cleanly cut out servo bays. Also included are hardware (including prebent control rods for the ailerons), a four-page instruction booklet and a set of plans that have been scaled down to about half size (critical areas are depicted full-size). The canopy was in perfect condition. Because this isn't a beginners' model, there is more than enough info for the experienced builder to assemble it.



The finished wing root with the ply rib and the locating pins attached. Note the pre-drilled servo-wire hole.



The wing-joining center brace as it is positioned in the fuselage before the half ribs have been attached to fill the holes.

SPECIFICATIONS

Model: Vari-Eze

Type: sport scale

Manufacturer: Obag (distributed by Hobby Lobby)

Wingspan: 56 in.

Wing area: 527 sq. in.

Wing loading: 22 oz./sq. ft., as tested (18.5 oz./sq. ft. for 8-cell direct-drive setup)

Length: 40 in.

Weight: 81 oz., as tested (71 oz. for 8-cell direct-drive setup)

Motor req'd: 7- to 10-cell geared or direct drive

Motor used: AstroFlight 15G

Channels req'd: 3 (throttle, ailerons, elevator). Test model used another channel for the nose wheel.

List price: $239

Features: gelcoated fiberglass fuselage, obechi-sheeted wings, laser-cut parts, full hardware package.

Comments: this is fun to build and take to the field. Its flight characteristics are excellent, and it can easily be flown by anyone who has aileron experience. It's a real crowd-pleaser that looks as good in the air as it does on the ground.

Hits
- High-quality materials and workmanship.
- Easy to construct.
- Wide range of suitable power systems.
- Excellent flight characteristics.

Misses
- Poorly translated instructions.
- Decals didn't stay on the covering long.

CONSTRUCTION

Begin by opening up the cooling holes in the fuselage and fitting the motor to the firewall in the back. This is the best time to mount the motor; later on, a wing-joining cross-spar will impede access. I've installed and removed my motor a few times since completing construction, so it can be done without a problem, but it's much easier to do the initial cutting and fitting now.

Now glue the root ribs to the wing-cores; this will show you where to drill for the locating pins and joining rods. The completed root-rib steps allow you to properly position the center beam and the fuselage former. The center beam is a sandwiched piece with a tube for the wing rod, and its position is determined by dry-assembling the beam, fuselage and wing halves.

When everything is aligned, you can epoxy the center beam to the inside of the fuselage by reaching through the cockpit area. When the epoxy has set, remove the wings, finish gluing the outer portion of the beam, and place the fuselage former against it. Describing these steps takes more effort than the actual process, but it's one that needs to be done very carefully and accurately because you can't change the wing position after you've finished.

Complete the fuselage by installing the rest of the formers, which also provide a base for the battery tray and the fixed nose gear on the forward bulkhead.

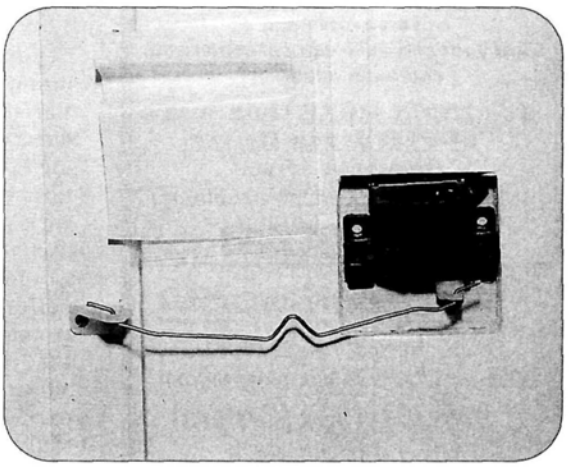
Because you set the root rib and pins when you set the center beam in the fuselage, wing construction is nearly complete. The removable "winglets," or vertical fins, are positioned against the outer wing rib and secured with plastic bolts. Small laths on the fins below the bottom of the wing prevent them from rotating around the bolts. The ailerons are already shaped and need only to be covered and hinged.

The preshaped, solid-balsa canard, or "duckbill," as the instructions call it, is ready to install. It's fastened to a wooden crosspiece that's glued to the underside of the fuselage cutout. The plans sheet shows just how much to cut off the elevator to clear the fuselage, but it isn't mentioned in the instructions, so study the plan carefully.

RADIO INSTALLATION

The wings require small servos that can lie on their sides in the servo bays, but there's room for full-size servos in the fuselage for the elevator. To save weight, I recommend that you use a small servo there, too.

I mounted the speed control on the forward side of the center beam and the receiver just below that on the fuselage floor, with the elevator servo under the battery shelf and ahead of the center fuselage former. After talking to Jim, I decided to make the model's fixed nose gear steerable, and I'm glad I did. I simply replaced the fixed gear with ½A nose gear and installed the servo opposite the elevator servo. Thin piano wire running through guide tubes travels inside the fuselage to control the elevator and nose gear.



The wing-servo bay with the servo, the supplied cover and the prebent control wire.

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING

This model likes a paved runway, although I managed to get it off a very short grass field once. It also doesn't allow you to force it off the ground before it's ready, so allow it to build up speed before you rotate. When it lifts off, it comes off the ground in a level attitude that can be a bit surprising, but climb-out is fine, and there's plenty of power, even for my extra-heavy experimental model. Landing is very easy, as this plane just doesn't stall. If you slow down too much, you'll find it just sort of plops onto the runway a bit harder than you would have liked.

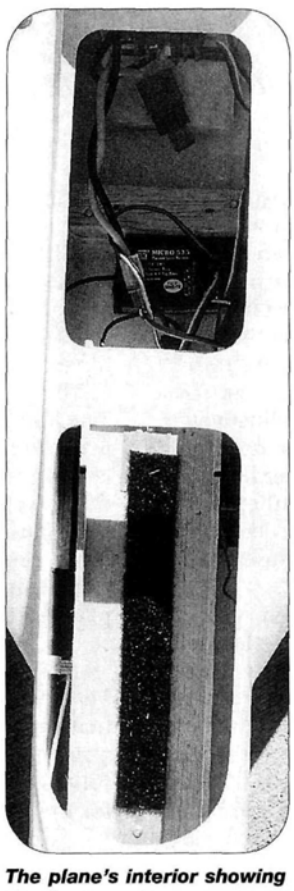
• HIGH-SPEED FLIGHT

I've played with a few props, and although I thought the 11x10 2-blade would be the better choice, the 3-blade 11x7 "feels" better in flight. Top speed is only around 50mph, so the Vari-Eze is not a rocket, but it's fast enough and has good control.

• LOW-SPEED FLIGHT

Because it's a canard, the Vari-Eze is predisposed to handle well at low speeds, and it certainly does. You can't stall it, but you can get yourself into trouble if you slow down too much and try to turn, so pay attention. So far, my only trouble arose because I played with the CG and put it a bit too far aft, but I had enough control to get the model back on the ground.

The control throws given in the instructions seemed to provide adequate response, although I've now increased elevator throw. During setup, it's important to fix both ailerons so that they are reflexed upward about 3mm when the controls are neutral. Perhaps the most difficult thing to remember when setting up the controls in a canard is that the elevator is set up "backward" because it's in the front of the plane. Don't make a mistake here.



The plane's interior showing the battery tray mounted above the servos.

POWER SETUP AND FINISHING

After discussing the options with Jim, I decided to try an AstroFlight* 15G motor on 12 cells, even though that's beyond the usual recommended cell range. Jim's Vari-Eze flew so well on direct drive that he thought the extra weight wouldn't be noticed. My only problem with using a geared motor was finding a prop that would provide the desired performance *and* clear the ground. I ended up with an 11x7 three-blade prop and still worried about prop clearance when the plane rotated. No problem; the model didn't really rotate, but it sort of lifted off in a level attitude. The battery tray is large enough to allow several types of battery configurations; I used stacks of 6 cells to make my 12-cell pack. This also allowed a lot of room for balance adjustment.

I covered the sheeted parts with Balsa USA* AeroSpan Cessna White and sprayed the fiberglass with Krylon white paint. Stripes made out of MonoKote* trim sheets add a bit of spice. The initial test flights were done before I added the stripes, and the plane's unique shape helped me to avoid being disoriented, even though the plane is all white and I flew it against clouds.

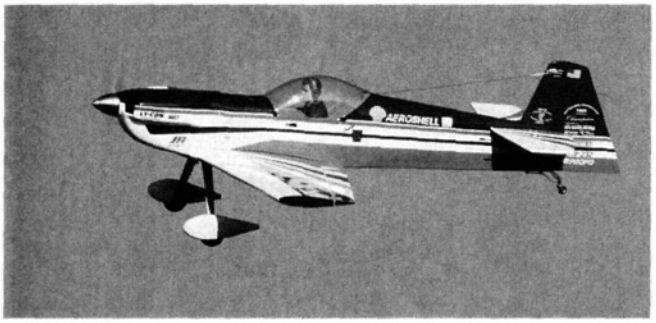
This is a very nice, high-quality kit that's easy to build and produces a fine looking model. Flight characteristics are satisfying, and I didn't note any bad tendencies, so any modeler who's capable of flying a low-wing aileron plane won't have any problems. Whether you go with the manufacturer's suggested setup or experiment a bit I'm confident that you'll be pleased with the Vari-Eze. It's a crowd-pleaser.

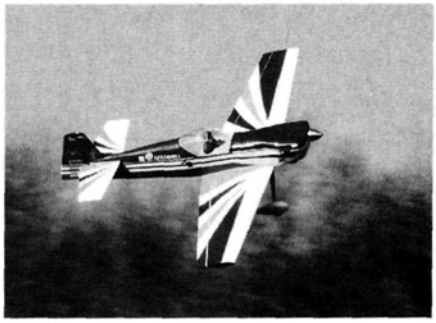
**Addresses are listed alphabetically in the Index of Manufacturers on page 126.*

WWW.SRBATTERIES.COM

Everytime we sit down to do a new ad, we don't know where to begin. If we do an ad about our battery packs, people call wondering if we're no longer making kits or publishing *R/C Techniques* and *Electric Flight Techniques*. If we do an ad about our kits, people think we're no longer making battery packs for modelers or that we've stopped pubishing *Techniques*. It often seems like there's no right way to keep you informed about what's new at SR Batteries. • Well, all of that has changed! Thanks to the world wide web, WWW, we can now not only keep you up to date, we can keep you up to the minute! If we release a new kit, you'll read about it two or three *months* sooner at srbatteries.com . If we release a new *Techniques* volume, you'll read about it two or three *months* sooner at srbatteries.com . And finally, if we release a new cell or technical information about one of our packs, you'll read all about it *first* at srbatteries.com! Naturally, our site lists pricing and technical information covering all of our products. You'll find the sizes and weights of all of our packs and individual cells as well as photos, specifications, and descriptions of our ARF and laser cut kits. In addition, there's a detailed index to all of the volumes in the *Techniques* library. • SR Batteries, Inc., Box 287, Bellport, NY 11713, Phone: 516-286-0079, Email: info@srbatteries.com

Remember the basics—fly better





Left: being a better pilot means flying your model more like a full-size aircraft; fly on the wing, not on the prop. Right: the new Hangar 9 CAP 232 is a great airplane to practice sport aerobatics with. Put purpose in your piloting. Flying precise headings and maneuvers is much better than just "whiz-banging" around waiting for the fuel to run out.

Becoming a giant-scale R/C pilot is as much a journey as it is a destination. "Bigger flies better" is the battle cry, suggesting that bigger models just fly better. I think what actually makes a difference is how big-bird modelers fly their models. Most of my big-bird flying buddies fly their models "on the wing," more like full-size aircraft; most smaller models are overpowered and tend to be flown "on the prop."

This time, I thought we'd look at ways to fly our models more like small, full-scale aircraft instead of just big models. Learning to fly better means remembering the basics.

STRAIGHT AND LEVEL

It may sound oversimplified, but flying any model straight and level requires a bit more effort than just holding the wings level and keeping the model pointed in the same direction. Flying a truly straight and level line is a combination of many small pitch, roll and yaw corrections. What's the biggest challenge to flying like a full-scale airplane? Coping with the wind—or at least the crosswind.

How many times have you seen a modeler launch his .40-size model straight out of the pilots' station because the wind was blowing straight into his face? It is a regular occurrence, and I have to admit, I've done it myself. With a larger model, however, this is seldom—if ever—the case.

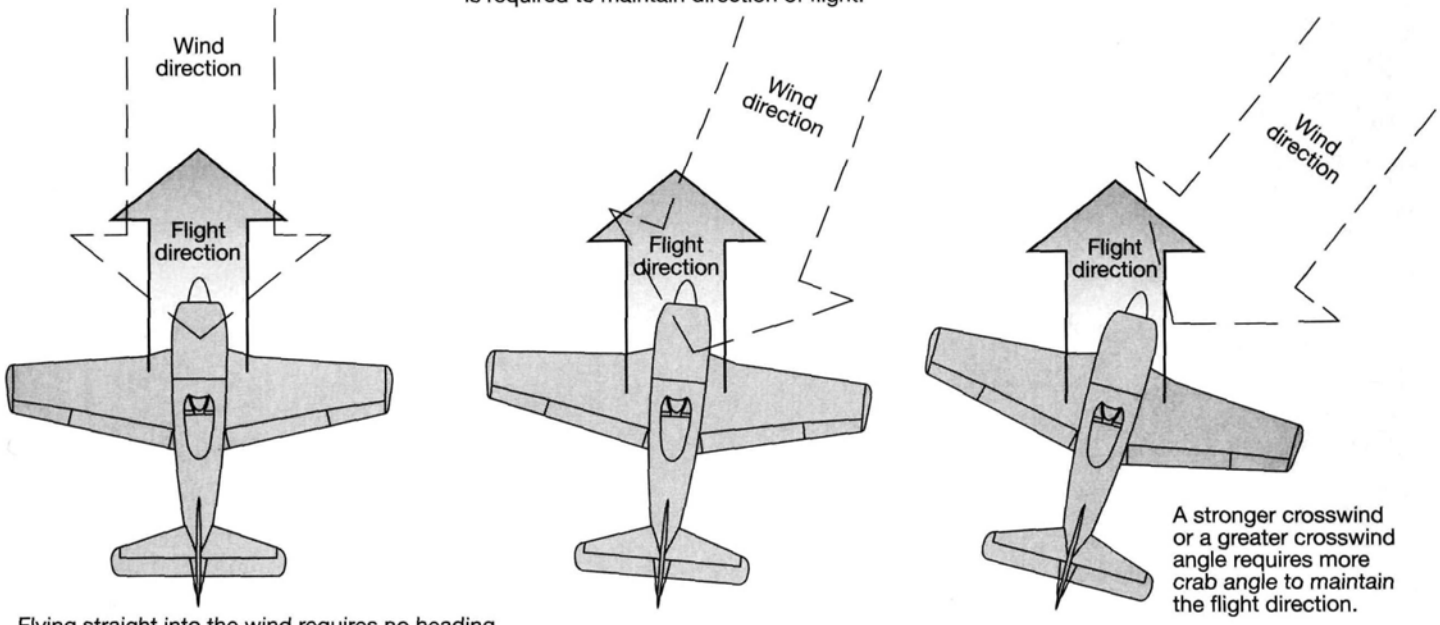
Big airplanes need long takeoff runs and so must use as much of the runway as necessary to develop enough airspeed for a safe departure, regardless of wind conditions. Why not practice flying in different wind conditions?

Use the centerline of the runway as your reference, and then fly your model about 50 feet above and on a parallel course with the centerline. Notice what you have to do to compensate for the effect the wind has on your airplane. Flying straight into the wind requires a certain power and elevator trim setting to remain at a constant speed and altitude. The downwind power and trim settings are slightly different. The effect, although very slight, is that ground speed changes, and you need to be aware of this to maintain a constant airspeed and altitude. Full-size aircraft pilots call this "situational awareness."

Now, if there is a crosswind, you need to "crab" the model slightly into the wind to track straight over the centerline. The strength of the crosswind affects how much crab angle is required to keep your flight path straight over the ground. The

Crosswind correction

When flying in a slight crosswind, some crab angle correction is required to maintain direction of flight.



Flying straight into the wind requires no heading correction. No rudder or aileron input required.

A stronger crosswind or a greater crosswind angle requires more crab angle to maintain the flight direction.

use of the rudder as well as the ailerons is required. In a very strong crosswind, the wingtip pointing upwind should be kept down slightly to prevent it from being lifted and rolling the model over.

Turbulence (wind gusts) also disturbs a model's flight path, but bigger models handle gusts better than smaller ones. For the most part, unless you're competing in a scale contest or an IMAC competition, slight deviations from true straight and level can be overlooked; that is, until you are setting up for more advanced maneuvers.

The effects of wind can also make left and right turns feel different from each other. Depending on the wind direction, your model will tend to climb or descend slightly in the turn, and this will further affect airspeed. Executing a 90-degree turn without losing or gaining airspeed or altitude is desirable. This is particularly important when you set up for your landing approach.

AEROBATICS?

For the most part, I'm talking about sport aerobatics here, not competition-level IMAC stuff. Anyone can do a loop or a roll fairly easily. But it takes practice to do them precisely and exactly where and when you want them.

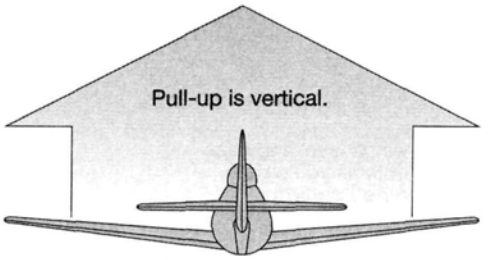
Start practicing your maneuvers about 100 to 150 feet above the ground, and then, as you gain confidence and precision, bring the maneuvers down to 50 feet or so. Try to imagine the centerline in front of you, then try to fly your model exactly over it. Regardless of the wind direction, you should be able to fly this line precisely and in either direction.

ROLLS AND LOOPS

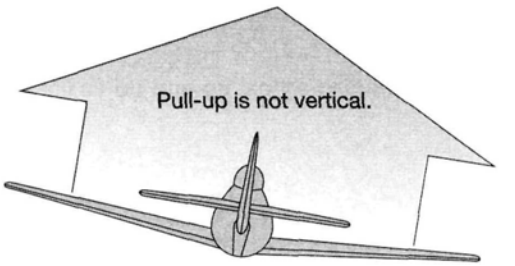
Every aerobatic maneuver is made up of combinations of loops and rolls (or parts of them). It isn't until you start demanding more precision from your thumbs that you'll find round loops and straight rolls aren't all that easy.

• **Rolls** (horizontal ones) look deceptively simple when done with a high roll rate. But start slowing them down (say 2 to 3 seconds per revolution), and you'll find that the demands on rudder and elevator increase. To do a roll in its simplest form (aileron input only), the model must start at a slightly nose-high attitude. This is because as you roll the model, the nose will begin to drop from the reduction of lift during the roll. Started straight and level with no elevator compensation, a roll will end up in a slight dive. Practice doing your rolls in a slightly arched flight path.

Entering a loop



Being straight and level at the entry of the loop makes the loop vertical.



If the model is not straight and level at the entry, the pull-up will be tilted to one side. The loop will not be truly vertical.

From straight and level, bring the nose up slightly (about 15 degrees) and add left aileron. Now, while holding left aileron, add a small amount of right rudder to hold the nose up as you enter knife-edge. As you go past knife-edge, start removing right rudder and start adding some down-elevator. As you enter inverted flight, all the right rudder should be gone, and the down-elevator should be holding the nose up. Now, as you break out of inverted, the down-elevator should be taken out slightly and some left rudder should slowly be added. As you enter the second knife-edge portion of the roll, the elevator should again be at neutral, and left rudder should be added to hold the nose up. Finally, as the model continues its roll back to straight and level, left rudder should be removed so the model exits straight and level. Whoever said a roll was simple?

Start doing rolls downwind, and as you get more comfortable, start doing them upwind. Finally, start trying to flatten them out (so they have less of an arch) and when that gets comfortable, slow the roll rate even more.

• **Loops** require the management of elevator, rudder, ailerons and throttle all at once so the loop will be as round as possible while keeping the model on a constant line. Enter the loop absolutely straight and level; otherwise, your loop will become a corkscrew-looking thing. As you pull up from straight and level, add a slight amount of right rudder to correct for engine torque and P-factor heading change as you raise the nose. As you come over the top and into inverted, keep the wings level. On the back side of the loop, the model will gain a lot of speed, so pull the throttle back. Adjust the elevator accordingly to keep the loop nice and round. Finally, at the bottom, as you exit the loop, you should be at the same altitude and heading as when you started.

A comfortable-size loop is one you can complete in about 5 or 6 seconds. Larger loops can take as long as 10 seconds to complete, but they'll need more corrections to keep everything on track.

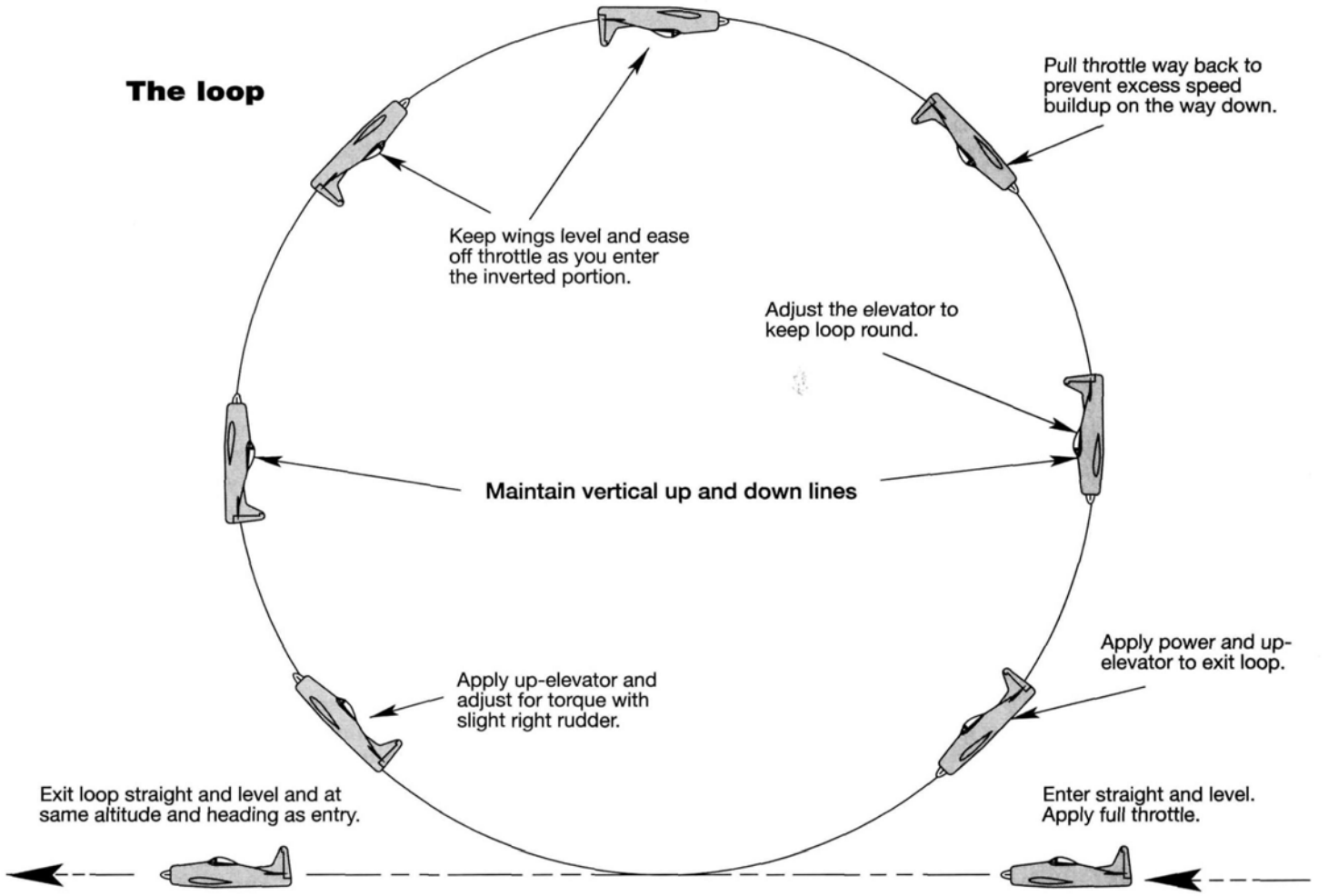
OTHER MANEUVERS

Combining loops and rolls brings you to more advanced aerobatics. An Immelmann turn is a combination of a half loop topped off with a half roll, placing the model at a higher altitude and heading in the opposite direction.

A Split-S is the opposite of an Immelmann, starting at a higher altitude with a half roll to inverted followed by a half loop. The model loses altitude and ends up heading in the opposite direction, hopefully straight and level.

Entering sustained inverted flight requires either a half loop or a half roll. Once inverted, slight down-elevator is required to keep the nose from dropping,

Practice landings on calm days and windy days; being able to land when and where you want—regardless of wind conditions—is a great accomplishment.



and in most cases, additional power is also needed. Another half loop or roll brings the model back to straight and level flight.

Throttle management is important in all aerobatic maneuvers. Use as much power as needed to do the climbing portions, and then throttle back on the way down. What you're trying to do is fly the maneuvers as smoothly as possible and at roughly the same airspeed throughout each part of the maneuver.

STALLS, SPINS AND SNAPS

Spins and snaps (snap rolls) are tied together in that they both require the model to stall before the maneuvers can be entered. A spin is an autorotation descent in which the model rotates around its CG location. Almost any models can be put into a spin, but some will spin better than others. The two important things for a good spin are proper CG location and having plenty of control throw. If the model's wing is not completely stalled because the model picked up speed in the descent, then it will enter a spiral. Before entering a spin, you might want to put the model into a slight climb to bleed off excess airspeed. If the model still doesn't want to spin properly, increase the elevator throw or add tail weight to bring the CG back a little at a time until the model does spin. Don't go crazy with the weight; you could add so much that the model becomes unstable and difficult to fly.

Climb to a safe altitude—say 250 feet—and start pulling back the throttle; also pull back on the elevator so you don't lose any altitude. When the model stalls and the nose drops past horizontal, apply full left rudder and aileron and hold full up-elevator. The model should spin its little heart out with its nose about 45 degrees below the horizon. If the rotation is slow, add more rudder throw, but do it a little at a time.

Recovery is very simple: let go of the controls! The model may rotate one or two more times, but it should recover by itself. Then let the nose drop naturally to un-stall the wing and regain airspeed. Gradually add up-elevator and apply some power to bring the model back to straight and level. In a perfect world, you should exit the spin on the same heading as you entered. If the model does not cleanly stop spinning, you can try applying a slight amount of opposite rudder and aileron to help halt the rotation.

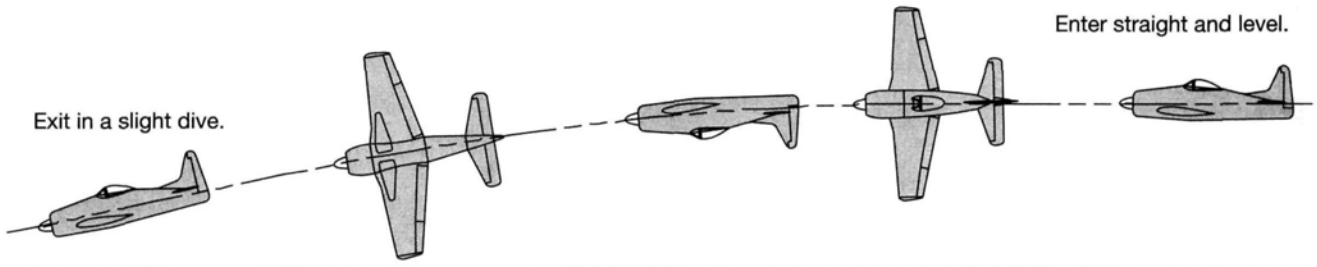
SNAP ROLLS

Many people are confused about what a true snap roll is. What it is *not* is a fast roll with rudder and up-elevator thrown in for good measure. For the model to truly enter a snap roll, the wing has to be stalled, just as for the spin. Think of a snap roll as a fast, horizontal spin. The model should again rotate about its CG.

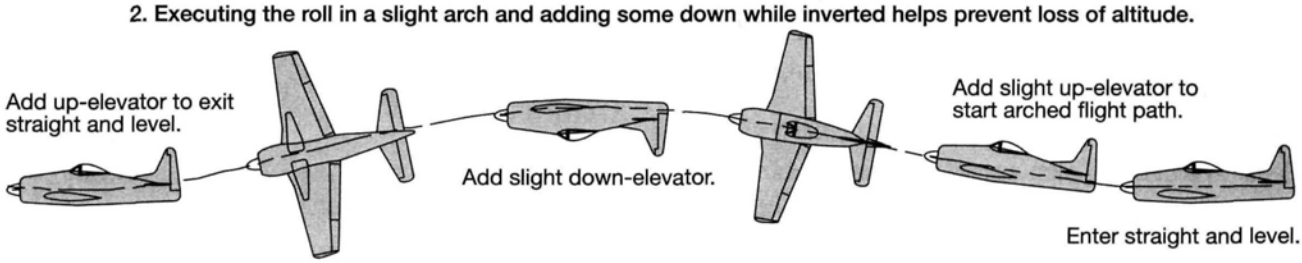
Reduce power to about half throttle (some designs might need even less power) and quickly apply full up-elevator, full right rudder and aileron. Hold the controls for about three-fourths of the snap's rotation and then let go. The model should stop snapping and may fly off in some other attitude and at a reduced speed. The model should really rotate quickly about the CG (much faster than a roll with ailerons alone). If the model did not rotate faster or if it went into a tight barrel roll, you'll need more elevator travel or you'll need to bring the CG position back a bit. Depending on where the model ended up after you released the controls, you may have to modify your recovery control inputs (elevator input first, quickly followed by rudder and aileron, etc.). What you want to do is have the model end up straight and level on the same heading as it went in.

The roll

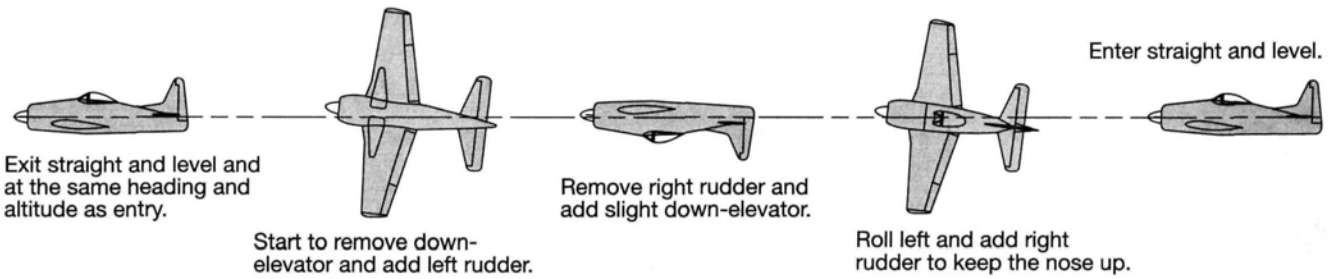
1. Because of the loss of lift, a roll will end in a slight dive if no elevator correction is applied.



2. Executing the roll in a slight arch and adding some down while inverted helps prevent loss of altitude.



3. Straight flight path with rudder and elevator correction.

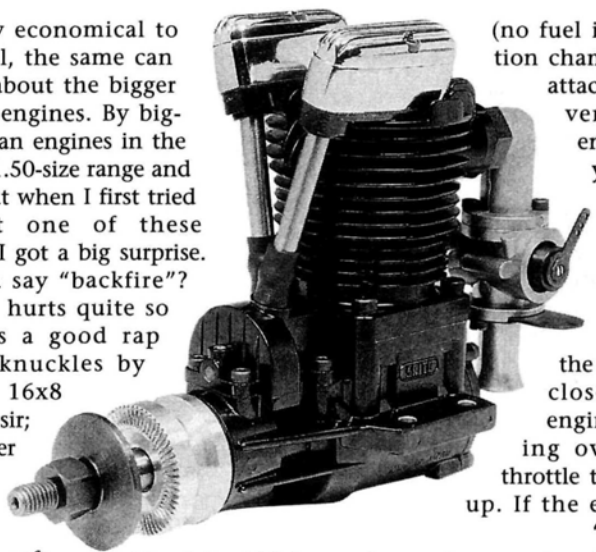


Four-stroke engines, especially the larger ones, are great powerplants to run—very powerful and economical. But starting them can be a bear unless you know a secret. Here, I'm making some adjustments to my Saito 1.50 GK-powered Hangar 9 CAP 232.

You don't have to become an IMAC competition pilot to become a better flier. But practicing aerobatic maneuvers, even the "easy" ones, will help you to hone your piloting skills. I don't think there's anything more boring than just "whiz-banging" around the sky, trying to burn up gas. Put purpose in your flying and try to build on the flight lessons you've already learned. Improving your skills is the journey!

STARTING BIG 4-STROKES

For the most part, I enjoy gasoline powerplants very much. They're easy to start and very economical to run. Well, the same can be said about the bigger 4-stroke engines. By bigger, I mean engines in the 1.20- to 1.50-size range and larger. But when I first tried to start one of these engines, I got a big surprise. Can you say "backfire"? Nothing hurts quite so much as a good rap on the knuckles by a Zinger 16x8 prop. No sir; I no longer hand-start big 4-strokers. I did, however, find a very easy, safe and foolproof way to bring a 4-stroke engine to life. Here's how.



The Saito 1.50 is a real powerhouse and develops a lot of torque. If you have problems starting your big 4-strokers, try my suggested starting procedure.

First, turn on your radio and have your buddy hold the airplane's tail. Set the throttle to the dead-idle, shut-off position (throttle all the way down with the throttle trim all the way down). Flip over the prop several times until you feel a lessening of compression (no fuel in the combustion chamber). OK; now attach the glow driver and spin the engine over with your electric starter. At this point, the engine will spin very easily, but it won't start because the throttle is fully closed. While the engine is still turning over, bring the throttle trim all the way up. If the engine doesn't "catch," add two or three clicks of throttle. The engine will then start and tick over nicely, just above idle. No muss, no fuss; just an easy startup without any bruised fingertips. Give it a try; if you have the needle valves set correctly and have fuel and spark, it works every time.

THE SHARK'S TOOTH maneuver is defined as a vertical segment and a 45-degree segment combined to give the overall appearance of a real shark's tooth when flown. In its simplest form, the maneuver can be flown by pulling vertical and flying for a minimum of 100 feet, then pushing the plane over 135 degrees until the path of the plane is on a 45-degree dive toward the ground. The maneuver ends with the plane flying upright at the same elevation as entered.

Flying the shark's tooth

IMAC Aerobatics

by Dan Wolanski

FLYING THE SHARK'S TOOTH

The first maneuver of the 1999 IMAC (International Miniature Aerobatic Club) Sportsman sequence is a centered shark's tooth, positive snap on a 45-degree downline. To perform this maneuver, you need to begin by flying your plane into the wind on a straight and level path parallel to the runway. I would suggest an entry height of approximately 100 feet, flying out at a distance of 100 yards. Now pull the plane upward at full throttle to a vertical climb well *before* you reach the center of the box. The radius of the pull does not need to be sharp, but it should be something that you can duplicate easily in the next two segments. Now fly vertical for approximately 300 feet to establish a straight and true vertical line.

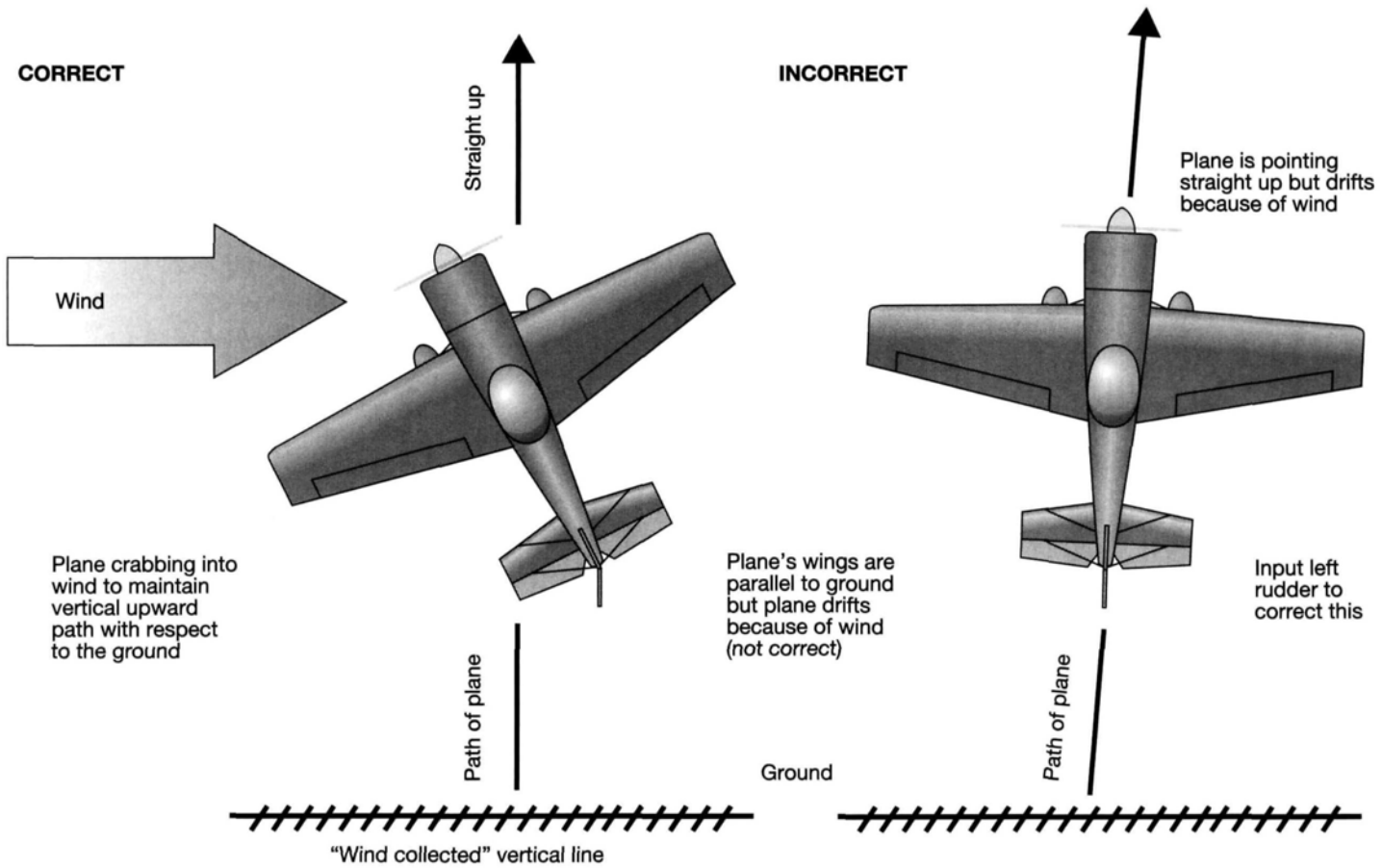
Once you have reached the top of the maneuver, push the plane over the top 135 degrees using down-elevator. The radius of this push should be the same radius that you pulled into the maneuver with. Immediately after you have the plane pointed down at a 45-degree dive, reduce the throttle to idle. This will prevent you from rushing the next segment and give you time to think about the upcoming snap.

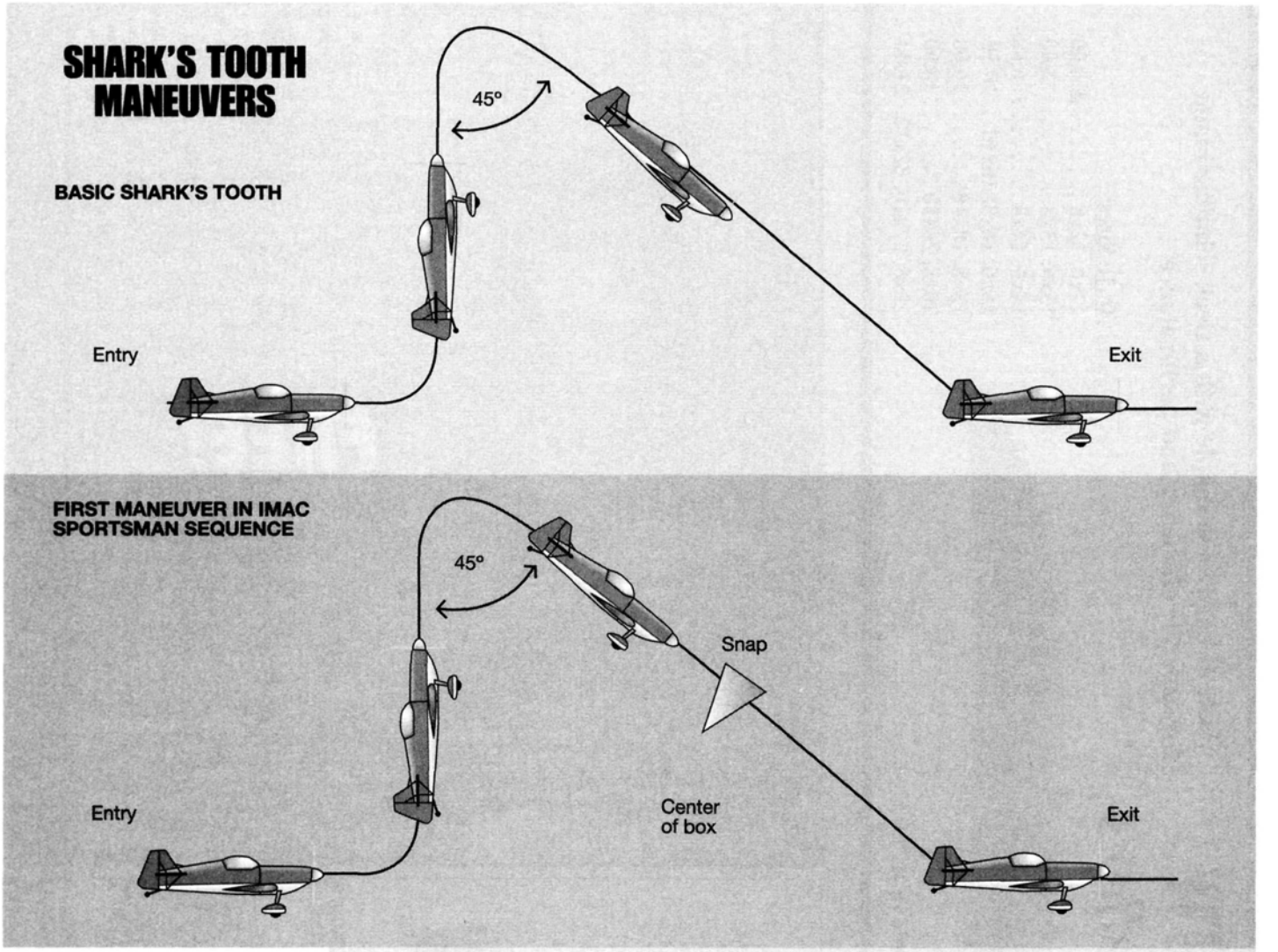
Continue flying at idle toward the ground at a 45-degree dive for approximately 200 feet. At this point, you should be approaching the center of the box and, at the exact same time, the center of the 45-degree segment. Now perform a positive snap in either direction (while still at idle) by inputting full rudder, full aileron in the same direction and up-elevator for a duration of one to two seconds, depending on your aircraft. To stop the snap, quickly release all of the transmitter inputs just before the plane reaches wings level.

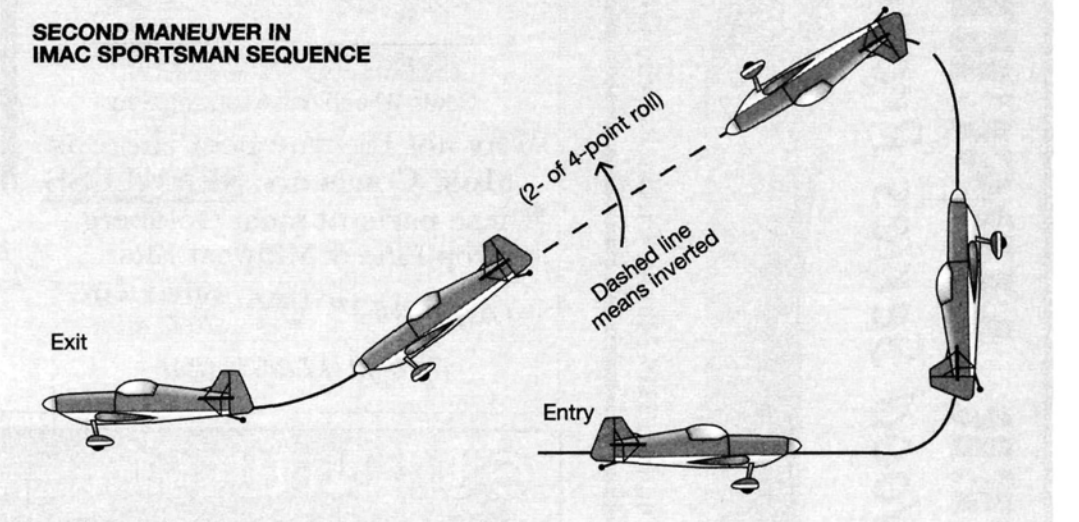
Once you have completed the snap, continue flying at the same 45-degree dive for approximately 200 more feet, then exit the maneuver at the same elevation as entered. The radius of the pull should be the same radius you used in the previous two segments.

SCORING

A perfect score for any maneuver is 10. IMAC downgrades are 1 point for every 10-degree deviation from the programmed line of flight. The downgrades are applicable for each axis (roll, pitch and yaw) and are cumulative. For example, if you attempt to pull your plane to a vertical climb, and your roll, pitch and yaw are each off 10 degrees, you would receive a 3-point deduction. Errors are rarely ever that large and are more likely to be a few degrees on one or two of the axes. Half-point downgrades are given when the cumulative variation is 5 degrees. Special note: all maneuvers, including vertical lines, will be judged as wind-corrected maneuvers. This means that the judges will look at the path of the plane with respect to the ground. Example: if you have a crosswind, your plane will need to "crab" into the wind at all times to







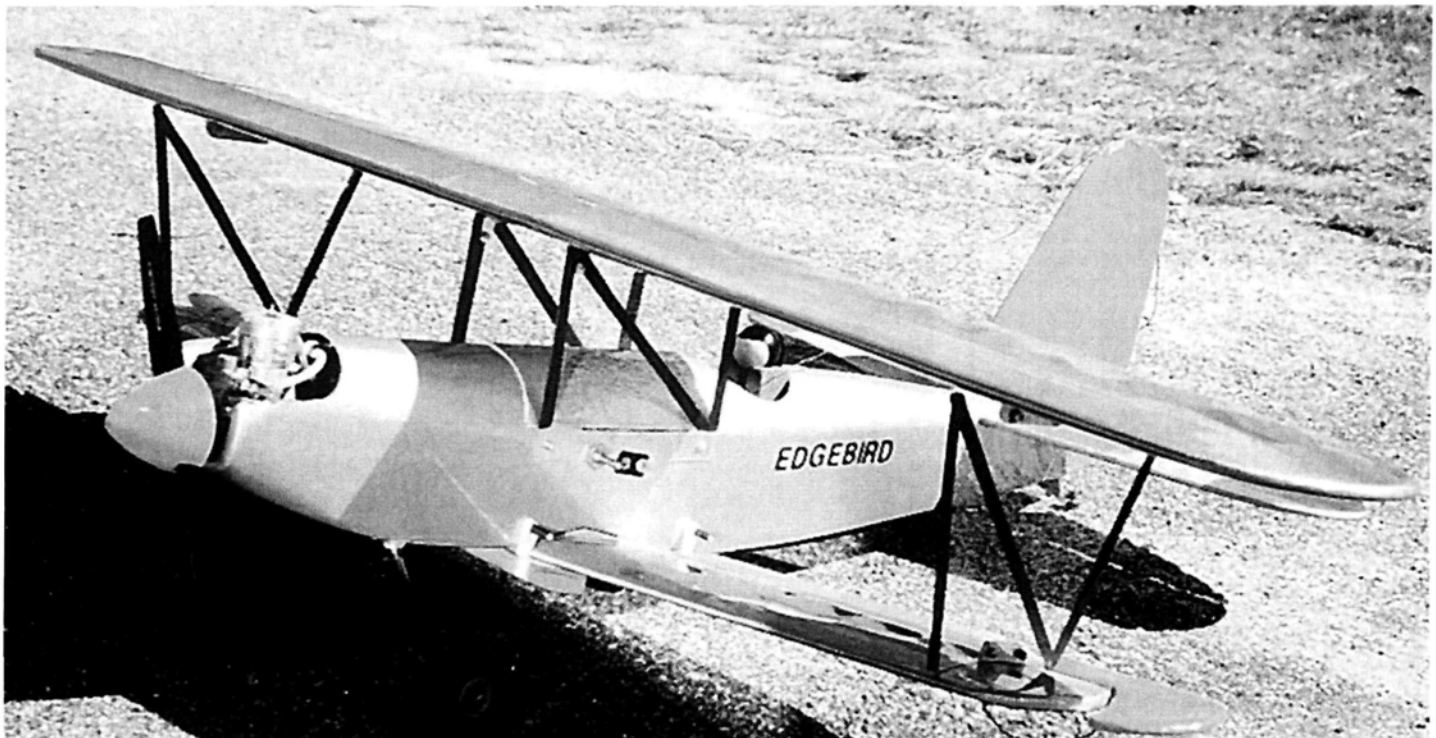
maintain the constant distance away from the pilot. This includes vertical lines (see sketch).

SHARK'S TOOTH DOWNGRADES

The first thing the judges will look for is whether your initial pull-up is a true 90 degrees. If your pull-up is not perfectly straight, *slowly* input the correction. Resist the temptation to "bang" the correction in. The next thing they will notice is your radius. Remember, there are three radii in the shark's tooth that all need to be the same; make sure that you fly one you can duplicate. When you reach the top, watch out for pushing the plane past a 45-degree dive. The judges will now be judging if your line is truly 45 degrees, or not, while anticipating the placement of your snap. If your snap is too early or late, it can cost you a 1- to 2-point deduction. Once you start the snap, all eyes will be focused on your wings. The judges will be looking for a clean rotation that stops at wings level. Be sure you nail the wings level first, then worry about the continuation of the 45-degree dive. Last, be sure to show a clean 45-degree line after the snap, and exit at the same height as you entered.

VARIATIONS

There are hundreds of variations to the shark's tooth. In fact, maneuver number two in the IMAC Sportsman sequence is a shark's tooth, 2- of 4-point roll on the inverted 45-degree downline. Even though the maneuver is flown basically in reverse, it is still considered a shark's tooth because it has a vertical segment combined with a 45-degree segment. The shark's tooth is often seen in the Advanced and Unlimited sequence with harder midpoint maneuvers. Go ahead and enjoy the shark's tooth maneuver. If you get bored, throw in a few point rolls or snaps on the upline. That should keep things interesting!



PHOTOS BY ROY L. CLOUGH JR.

Add Plastic Interplane Struts

by Roy L. Clough Jr.

Knife-edge flight made easy!

KNIFE-EDGE FLYING has fascinated me since, as a youngster, I watched pilot Bob St. Jacques fly his WACO, on edge, the full length of the old Laconia, NH, airport. It just didn't seem possible, but he did it!

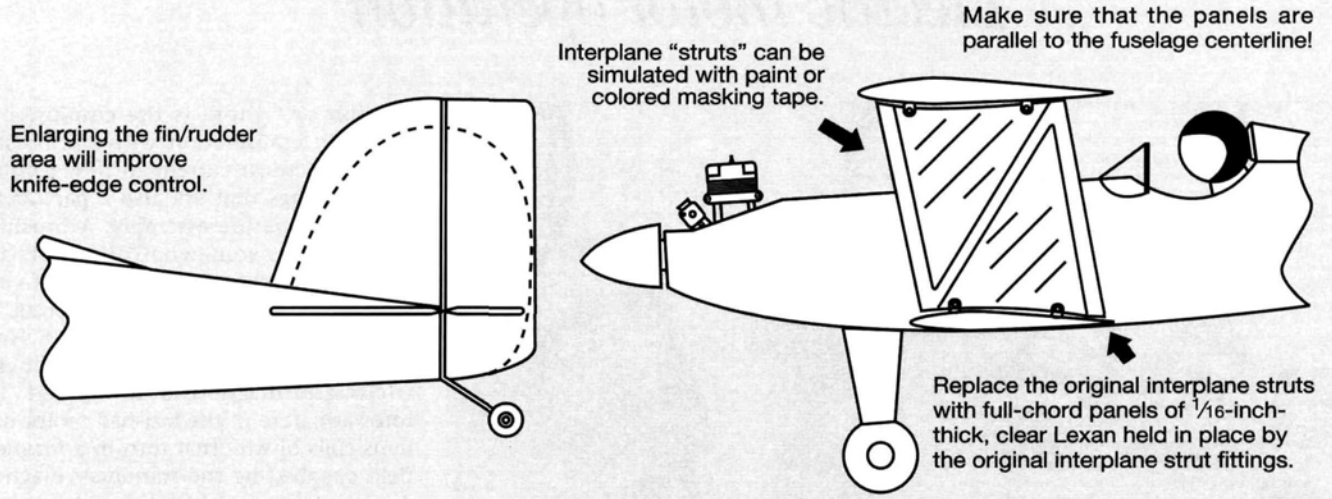
Attempting this stunt with R/C models reminded me that for years, I had nurtured the idea that biplane interplane curtains would do the trick. I hadn't tried it because I seldom build biplanes. When fellow Winnipesaukee Radio Controllers Club member Chip Richards made me an offer I couldn't refuse—a "Wizard" biplane with a 6-channel radio—I saw a chance to try it the easy way.

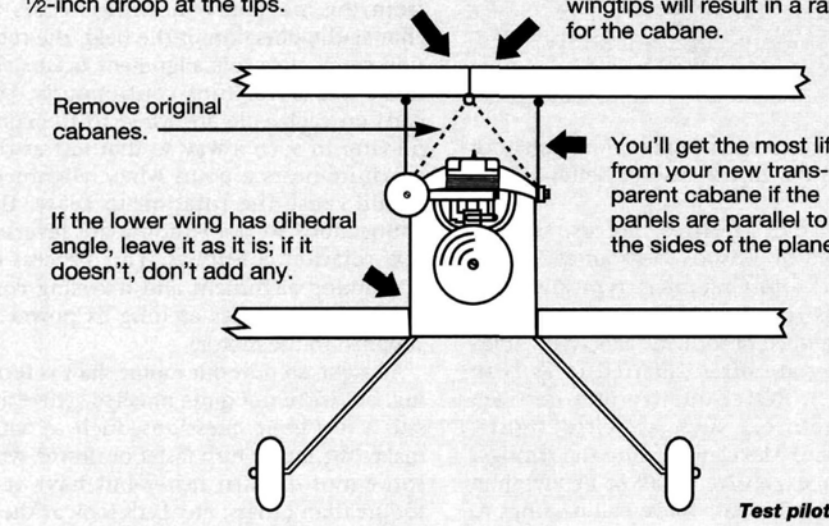
For my first attempt, I rebuilt the fin and rudder and enlarged the ailerons to suit my prejudices in such matters. The interplane struts were replaced with chord-width panels of 1/16-inch-thick clear Lexan with strips of black masking tape to fake the struts. This added 40 percent more area to the side area of the plane. Knife-edge flight was possible but required a very delicate touch of thumb.

After several fellow members had flown the plane, the consensus was that the dihedral of the upper wing was fighting the aileron input. For my second attempt, I flattened out the dihedral to the point of having slightly drooped wingtips. This raised the center section well above the original, somewhat clunky, plywood cabane. I removed it and made new Lexan panel cabanes, complete with fake struts. The result was a total panel area of 160 square inches, and the flattened wing allowed a reasonably skilled pilot to keep the plane on edge indefinitely.

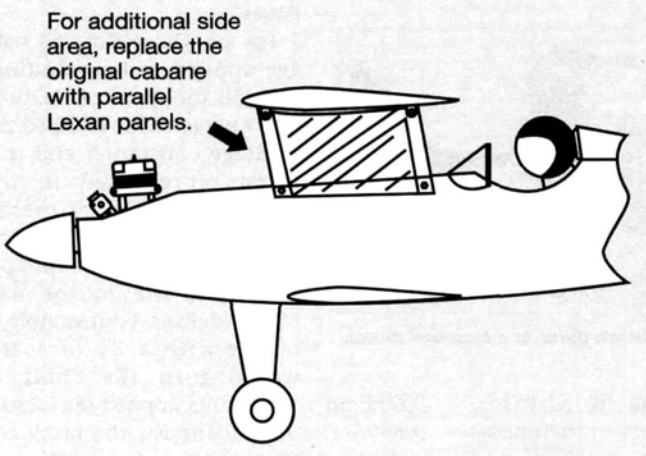
I'll be modest, but I have to tell you the guys in the club think this is a terrific idea. It's easily adapted to any biplane, and taping on or painting struts over clear plastic is much easier than building up N-strut assemblies.

BIPLANE CONVERSION





Note: although I was initially concerned about the absence of diagonal bracing with this arrangement, the Lexan panels proved stiff enough to make it unnecessary.



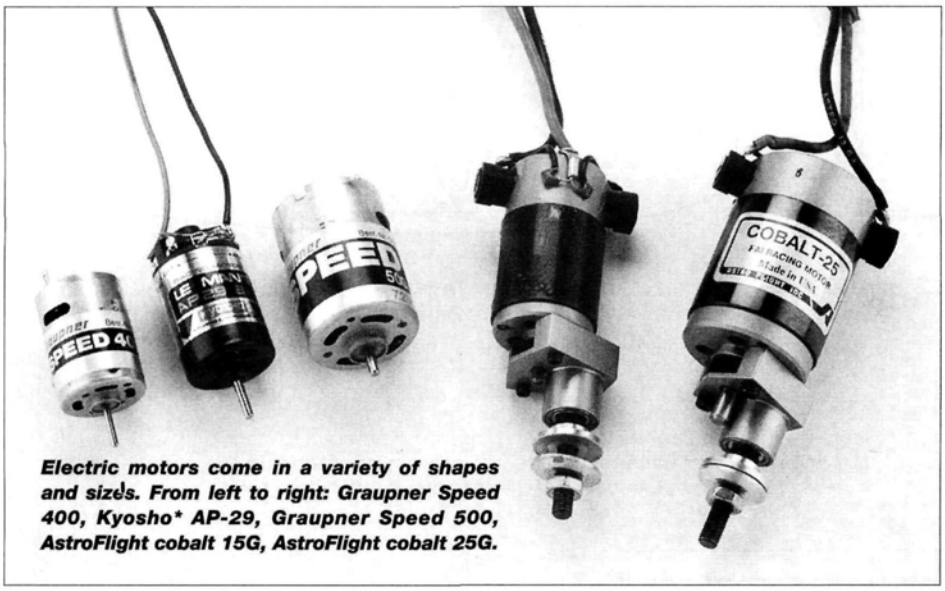
Test pilot Armand Cote points out the plastic interplane struts.

My reworked Wizard has a 54-inch span and is 42 inches long, and it fits nicely into my station wagon. It could, however, be reduced to a much smaller package by removing the top wing (which is held with eight, 3-48 locknuts) and the lower wing (held with six rubber bands).

One of the neat things about this arrangement is that while standing at a distance, no one ever notices that the interwing strutwork is simply painted onto transparent plastic panels! ✚

 by Tim McDonough

Electric motor operation



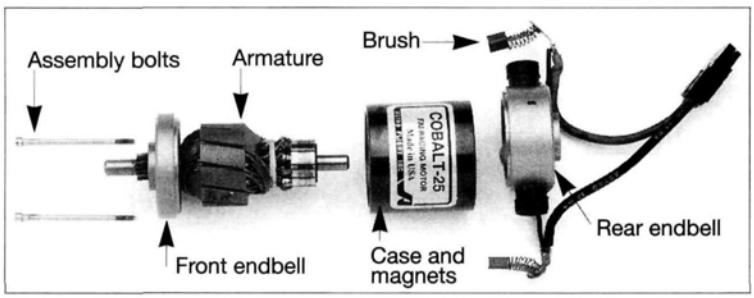
Electric motors come in a variety of shapes and sizes. From left to right: Graupner Speed 400, Kyosho* AP-29, Graupner Speed 500, AstroFlight cobalt 15G, AstroFlight cobalt 25G.

I'm always surprised when someone completes a flight with an electric-powered model at a field where most aircraft are glow- or gas-powered, and I hear the comment, "That flew well for an electric airplane." All other things being equal, if two models weigh the same and the power plant—be it an electric motor or a glow engine—turns a given prop at the same rpm, the model will fly the same. The airplane has no idea what's being used to turn the propeller and, in fact, it doesn't matter.

There are a number of reasons we hear comments like the one above. For one thing, most modelers have probably seen a lot more glow-powered planes fly than they have electrics. Also, the majority of people probably feel they understand how a wet-fueled engine works, while the workings of an electric motor may be somewhat of a mystery. My goal this month is to take a little of the mystery out of how an electric motor does its job.

Several types of electric motors are available. The particular type used in our models is referred to as a permanent magnet direct current (DC) motor. All of the motors we use operate from the DC supplied by a Ni-Cd battery. They contain magnets that are typically made of ferrite, in the case of lower-cost motors, or a rare earth material such as samarium cobalt or neodymium, in the case of better-quality motors.

Lower-cost "ferrite" motors, such as those sold by Leisure Electronics*, Master Airscrew* and Graupner* typically have bushings to support the armature shaft and a stamped or formed "can"-type housing (they are often referred to as "can motors"). Better-quality motors from manufacturers such as AstroFlight*, Aveox* and MaxCim* feature the stronger but more expensive cobalt or neodymium magnets and usually have ball bearings to support the shaft in machined cases. Today's popular motors vary in their physical size as well as their capacities, and proper selection of a motor for your project is fundamental to success.



A disassembled AstroFlight 25, showing the basic parts of a brushed motor.

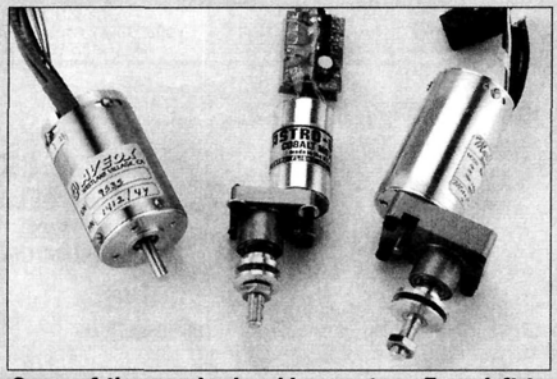
The motor's job is to convert electrical energy into mechanical energy. The stationary parts of the motor, collectively called the "stator," include the magnets, brushes and brush holders. The rotating portion or "rotor" is the commutator, which in conjunction with the brushes allows electrical current to flow through the windings that are also a part of the rotor or armature assembly. A brushless DC motor is somewhat different, and these differences are discussed in the sidebar, "Brushed vs. Brushless Motors."

In 1819, Danish physicist Hans Christian Oersted demonstrated that electricity and magnetism are related. The rotor/armature of the brushed motor contains coils of wire that turn in a magnetic field supplied by the stationary magnets. A coil of wire with an electric current flowing in it will turn until the coil physically aligns itself with the magnetic field from the magnet. If nothing occurs to change the direction of the field, the rotation stops once this alignment occurs. To make the motor turn continuously, the coils on each pole are wired to the commutator in such a way so that just as the armature nears a point where alignment would cause the rotation to cease, the connections to the winding are reversed and rotation continues. This process of attempting alignment and reversing connections continues as long as power is supplied to the motor.

All right, so now our motor shaft is turning, but we're not quite finished. There are still a few basic questions, such as what makes the motor turn faster or slower, why some motors turn faster but have less torque than others, etc. Let's look at these issues.

For any DC motor, the voltage applied to the windings controls the speed of rotation. This characteristic is called the "voltage constant," and it is often represented in the motor manufacturer's specifications by the symbol Kv. The Kv of the motor is the rpm per volt that the motor will ideally deliver. For example, a motor with a Kv of 1,200 would turn the shaft at 9,600rpm with 8 volts applied (8x1,200 = 9,600.) The higher the Kv, the faster the motor shaft will turn for each volt applied.

Before you toss down the magazine and run out to get a motor with a huge Kv, there's another relationship you need to be aware of: every motor also has a torque constant (Kt) that's inversely proportional to the Kv of the motor. Kt is the amount



Some of the popular brushless motors. From left to right: Aveox 1412/4Y, AstroFlight 020, MaxCim Neo-Max15.

BRUSHED VS. BRUSHLESS MOTORS

In 1992, Aveox introduced the first commercially produced brushless motor designed for modeling use. The basic operating principle of a brushless motor is essentially the same as the more common brushed variety, but the construction is quite different. In a brushless motor, the permanent magnets are located on the rotor or armature, and the windings are stationary and attached to the motor's outer case. Since the windings do not rotate, the commutation must be done electronically rather than mechanically. A microprocessor circuit that includes an integrated electronic speed control performs this electronic commutation.

Brushless motors are more complicated (and hence more expensive) to manufacture; so why use them? There are several advantages to a brushless motor. First, the heat generated in the windings is more easily dissipated, since the windings are in direct mechanical contact with the motor case (which acts as a heat sink/radiator). Cooler running motors are always better. Also, since there are no brushes and mechanical commutator to contend with, higher motor speeds are possible, and the conversion of electrical energy into mechanical energy is more efficient. The bottom line is that more of the energy stored in your battery pack gets used to turn the prop!

A wide variety of brushless motors is now available from U.S. companies such as AstroFlight, Aveox and MaxCim, as well as from several European manufacturers. Offerings from any of these are worthy of serious consideration if you want the ultimate in efficiency and performance to power your next electric model.

of torque the motor can deliver at the shaft and is rated in ounce/inches per amp of current. What this means to you, the user, is that a high Kv motor cannot deliver as much torque as a similar-size lower Kv motor.

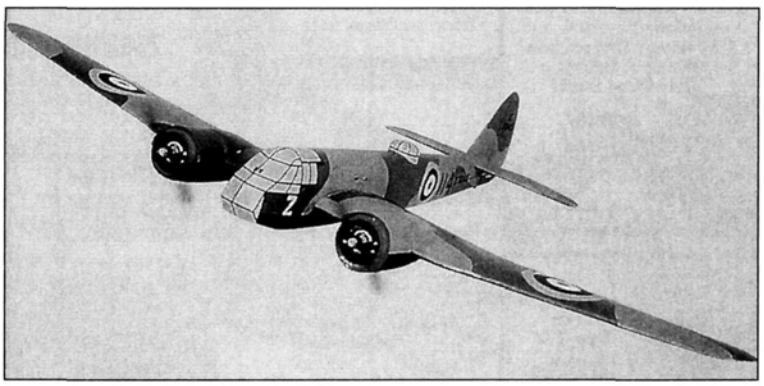
This description is a simplified model of an actual motor's operation. There are other factors beyond the scope of this column that come into play, although Kv will have the largest effect, making it the one to look at when comparing various motors.

Electric motors have limits, as do most things. A motor will have some maximum rpm at which it can safely operate. There will also be a maximum amount of current that can safely flow through the brushes and windings. Routinely exceeding these limits may have catastrophic effects on the motor and possibly, on your airplane. Exceed the maximum voltage for too long, and the brushes may float off the commutator, causing excessive arcing that can burn and pit the surfaces, reducing efficiency. At really extreme rpm, the wire windings may literally come off the armature, and if you exceed the motor's maximum current rating, it can melt components. All these things can destroy the motor; in some cases, the failure could also end up destroying your model. With the time, effort and money you invest, it's best to avoid a disaster by choosing the correct motor.

It's important to draw from this analysis a very basic fact that's often overlooked in discussions of power systems. Electric motors, like all other model powerplants, do not produce thrust; they produce torque and rpm. You need to select a motor that will allow you to swing the size prop you need at an rpm that will fly your model well. Larger props need higher torque than smaller ones. This is where gear or belt drives come into play with larger props, as they can "convert" rpm to torque, but that's a topic for another column.

BALSACRAFT WARBIRDS IN NORTH AMERICA

If you're old enough to remember the "British invasion," the term probably generates visions of the Beatles and the Rolling Stones. But a new British invasion of sorts has come in the form of warbird kits from Balsacraft*. Great Planes Model Distributors is starting to import the kit line based on Pete Nicholson's designs. These planes have been very popular in Europe, and some plans have made their way across the pond; we've seen a few of them at electric meets around the country.



Here's Balsacraft's new Blenheim. Powered by two Speed 600 motors, it should fly great.

Great Planes has announced the availability of Balsacraft's Blenheim (60 in.), Hurricane (46 in.), Bearcat (45 in.) and Sea Fury (48 in.), with more designs to come in the future. All of these aircraft are designed to be powered by Speed 600 motors, though AstroFlight motors are popular choices as well. They should also fly well with a .15 glow motor, but they'll be a bit louder. The kits come with nice machine-cut balsa and ply parts, plastic cowls and a super decal sheet. I will be building their Blenheim kit, so you'll hear more from me later. While these kits should be available by the time you read this, check with Great Planes for availability.

As always, you can contact me via email at tim@mcdonough.net.

**Addresses are listed alphabetically in the Index of Manufacturers on page 126.* ✦

GRASSROOTS *by CHRIS ABATE*

Reports from readers around the world!

Send in your event coverage. Mail photos, captions and text (500 words or less) to "Grassroots," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Color slides and prints are acceptable.

Hawks 4-Cycle Rally

If you enjoy using and flying 4-stroke engines and you live in southern Ohio—near Hamilton, to be exact—the Hawks 4-Cycle Rally is the place to be. Sponsored by the Hawks R/C Club, O.S. Engines and Great Planes, this rally is well organized and well run, and it boasts a great flying site with a paved runway and taxiways.

Goldberg Chipmunk by Michael Trueblood.

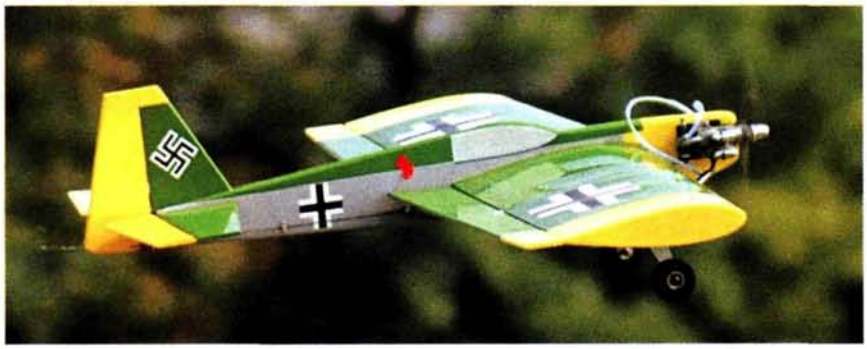
Cliff Hall likes Sig Kadets so much that he bu them. All are powered by O.S. engines.

Chris Abate's Nieuport 11 was first in Scale at last year's rally.

Great Planes' demo flying team puts the new IMAA-legal Douglas DC-3 through its paces.

Dave Wood took fourth-place honors with his F4U Corsair.

Chris Abate's Sig Space Walker was first seen on the pages of* Model Airplane News *as a kit review back in 1988. Still looking good and going strong.



Left: Bob Hozeska took a Sig Fazer and decided to try a different color scheme. The model is impressive in flight and looks.

John Werne is off for another hop with his Nieuport 28 powered by an O.S. 300 twin.

The events are basically the same from year to year and include: Spot Landing (just hit the runway), Pilots' Choice, Static Scale, Old-Timer, Mini-Pattern (a loop, roll and figure-8, and if you do anything at all that resembles these maneuvers, you're in the running) and last, but not least, the infamous Bomb Drop. After you've completed a particular event, your name is entered in a drawing to determine the winner. This way, the hotshot pilots aren't the only ones who go home with all the goodies. Static Scale judging is by the AMA scale rules, and flying is not judged, but the aircraft must fly at least one circuit of the field in a safe manner. To qualify for the Old-Timer event, the model must be a design that was kitted or published before December 31, 1942, and the aircraft are judged on their looks and flying capabilities.

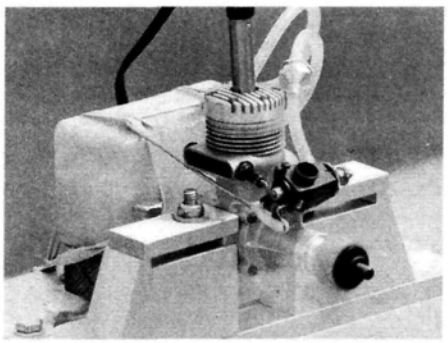
The really neat part of this rally is that all of the awards are 4-stroke engines! The club also held a raffle for an O.S. FS 1.20 and for a complete, ready-to-go aircraft.

PHOTOS BY CHRIS ABATE

The Peak Horsepower Game

We regularly get correspondence here at *Model Airplane News* that, in one way or another, has to do with many of you guys making engine-purchase decisions based on the horsepower ratings claimed by manufacturers. Now, before I get started, I know I'm probably going to get a few nasty letters from the scientific and engineering communities berating me for oversimplifying, and I may hear some complaints from engine makers, too. So let me state in advance that I'm sorry if I ruffle any technical or marketing feathers, but I really feel that something needs to be said to help us R/C sport flyers.

The horsepower ratings claimed by manufacturers in the specifications for any given sport engine (note, I said sport) are, for all intents and purposes, meaningless to us sport flyers. There; I said it. Keep in mind when I use the word "sport," I'm referring to engine applications for sport/pattern, sport/scale and the preponderance of exact-scale applications (depending on the subject modeled). The groups just described encompass some 85 to 90 percent of the prop-driven designs we modelers fly, and



I'm sure that this is a conservatively low estimate. The exception, of course, would be engines manufactured by a company such as Nelson, whose engines' porting is specifically timed to run at much higher rpm because they're intended to turn small-diameter props, the potential of which can only be realized on comparatively very-low-drag airframes. But matching specific props to a given airframe's inherent drag is another subject for another time.

When looking at a given hp rating in the manufacturer's specification table, the important item to notice is at what rpm the hp rating was taken. Some manufacturers go as far as to state only hp with no rpm figure—shame on them! For argument's sake, let's say that the manufacturer's claimed hp figure for a certain engine is 2.3hp at 16,000rpm. I'm not here to dispute the accuracy of manufacturers' stated figures or their marketing motives for wishing to state the highest possible figures, but I am asking you to consider the propeller that will be needed to allow the engine to turn these high rpm levels and produce commensurately high hp levels. You'll find that the prop is far from appropriate for most of the models we fly today.

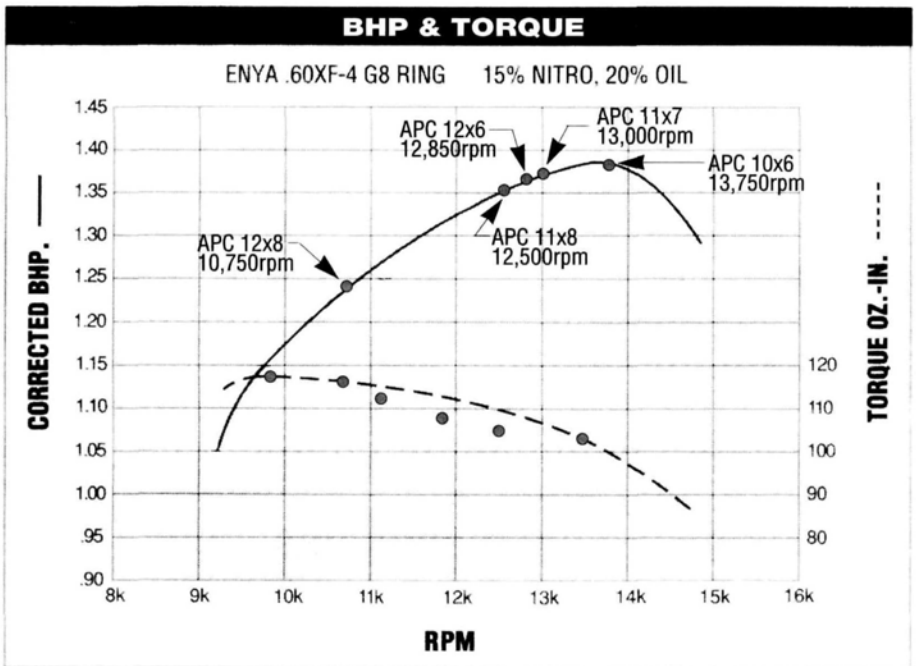
Remember, no matter what the hp rating, an engine alone does nothing for us. It's the prop that produces sufficient thrust to fly a specific airframe. And the best prop to do the job needs the right combination of hp and torque.

All too often, we forget about torque (which can be defined simply as "twisting force"—in the case of our engines, a twisting force at the crankshaft). Torque is force times radius (t = f x r); the force being supplied by the piston via the rod, and radius being the distance from the center of the crankpin to the center of rotation of the crankshaft. It's this twisting force that determines how quickly an engine will accelerate from one rpm to a higher rpm.

While an engine may produce high levels of hp with a small prop, it's the right combination of torque and horsepower that enables it to turn a prop of sufficient size to overcome the drag presented by our models as they move through the air.

If the engine delivers adequate horsepower throughout its operating range (rpm), sport models generally work best at lower than peak horsepower rpm, where torque is high—the domain of larger props. The only caution pertains to overloading the 2-stroke engine. A good rule suggests keeping rpm above 10,000; otherwise, without special modifications, engines tend to overheat and become erratic below this rpm range.

For most of us modelers, larger props—definitely larger than those used to obtain maximum peak horsepower ratings that look good in a spec chart—are far more efficient at producing the thrust needed to fly our models. For happy modeling, the things I feel you should look for when making a buying decision are reliability, good throttle response, good idle, quiet operation, vibration levels and, of course, good metallurgy for longevity. Just my opinion; let me know yours. ✦



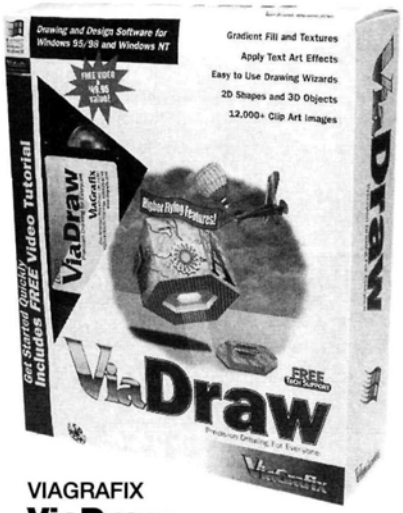
This shows the horsepower curve (solid line) and torque curve of an Enya .60 XF, one of the best sport engines available (in my opinion), with standard muffler. Note: while peak horsepower is obtained with an APC 10x6 prop, this prop is far from optimum for the .60-size models we fly. If you know the torque curve of your engine (whether from published reviews or manufacturer's literature), do this: prop the engine to operate within the top 10 percent of its peak torque, but above 10,000rpm. Peak torque for the Enya is 118 oz. at 9,800rpm. Ten percent of this is about 12 oz.-in.; 118-12 = 106 oz.-in. Track the torque curve to 106 oz.-in. and you see (correction factors considered) this falls roughly between 12,500 and 13,000rpm. Note: the APC 12x6, 11x7 and 11x8 fall right in this rpm range and are optimum for the sport/scale and sport/pattern models we fly.

PRODUCT NEWS

Latest product releases

INFORM YOUR CUSTOMERS! **Model Airplane News is interested in showing our readers your new products—here in Product News. If you'd like to see your products here, send us clear photos and a press release that provides information about them! We'll publish as many as space permits.**

Send your announcements to: Product News, Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606 USA.



VIAGRAFIX

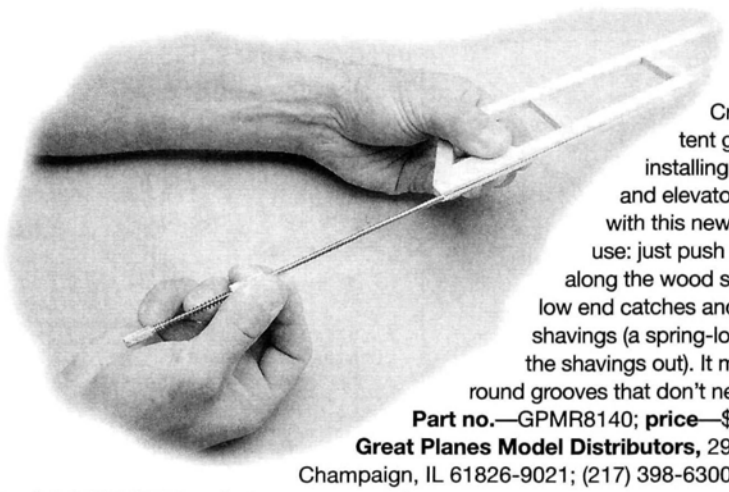
ViaDraw

This new program can be used with ModelCAD and DesignCAD and will allow you to draw 2D shapes and 3D objects, stretch and zoom them and apply fills, shadows and art effects in text. You can also scan in a photo, add 3D text and export the graphic to a Web page. The program comes with a free video tutorial.

System requirements: Windows 95, 98 or Windows NT.

Price—$149.95.

ViaGrafix, One American Way, Pryor, OK 74361; (800) 2339-3223 or (918) 825-7555; fax (918) 825-6744; website www.viagrafix.com.



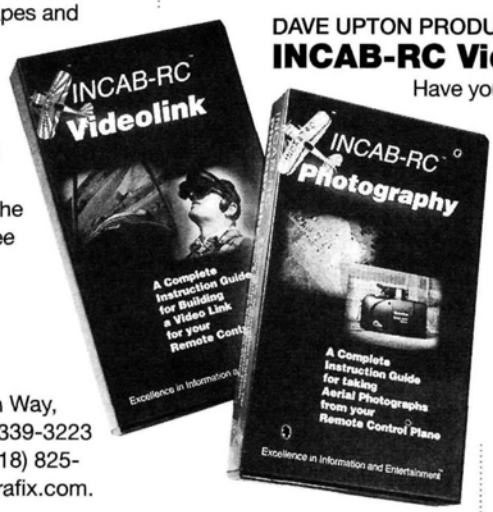
GREAT PLANES

Groove Tube

Create clean, consistent grooves in balsa for installing aileron torque rods and elevator inter-link wires with this new tool. It's easy to use: just push the Groove Tube along the wood surface, and its hollow end catches and holds the balsa shavings (a spring-loaded plunger forces the shavings out). It makes uniformly round grooves that don't need to be sanded.

Part no.—GPMR8140; **price**—$5.99.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008; website: www.greatplanes.com.



DAVE UPTON PRODUCTIONS INC.

INCAB-RC Videos

Have you ever wanted to install a still camera or a video camera in your model airplane? These two new videos show you how. Each details the equipment and accessories you'll need for the project, then it takes you step by step through installation while providing other hints and tips.

Prices—$24.95 (aerial photography video), plus $3.95 S&H, $29.95 (videolink video), plus $3.95 S&H.

Dave Upton Productions Inc., 4487 Knoop Ave., Eugene, OR 97402; (541) 683-5445; email: dave@incab-rc.com; website: www.incab-rc.com.

NORVEL

1/2A Tutor

This 47.5-inch-span model is easy to put together and easy to fly, and the kit comes with a three-color decal sheet and high-quality wooden parts that fit together perfectly. You'll need a 3-channel radio and a .049 to .061 engine for power, and Norvel offers a variety of kit/engine/radio combination deals; call for more information.

Price—$37.99 (model only).

Norvel, 2244 E. Enterprise Pky., Twinsburg, OH 44087; (800) 665-9575 or (330) 425-3631; fax (330) 425-3935; website: www.norvel.com.

ANCHOR SEAL

Finishing Resin and Fillers

Anchor Seal's finishing resin is strong, has a low viscosity and odor and isn't brittle. It has a 30-minute pot life and a 150-minute cure time, and it uses no Mercaptan. The fillers include short fibers for heavy-duty reinforcing; lightweight thickening filler for no-drip, no-sag applications; and lightweight microballoons for fairing and cosmetic filling.

Prices—$9.95 each, 9-oz. kit (epoxy), $4.25 each, 25 fl. oz. (fillers).

Anchor Seal, 16 Riverside Ave., Danvers, MA 01923-3281; (978) 774-5217: fax (978) 774-0638; website: www.anchorseal.com.

KYOSHO

Cessna Skylane ARF

This kit features a fiberglass-reinforced, plastic fuselage covered in white gelcoat and built and covered sheeted foam-core wings. The cowl and wheel pants are also fiberglass-reinforced plastic with a white gelcoat. The kit comes with landing gear, an engine mount, wheels and a 270cc fuel tank. Specifications: wingspan—62 inches; wing area—495 square inches; weight—5.3 pounds; length—43.7 inches; engine recommended—.40 to .46 2-stroke or .45 to .60 4-stroke; radio required—4-channel with five servos.

Part no.—KYOA1027; **price**—$299.99.

Kyosho; distributed by Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008.

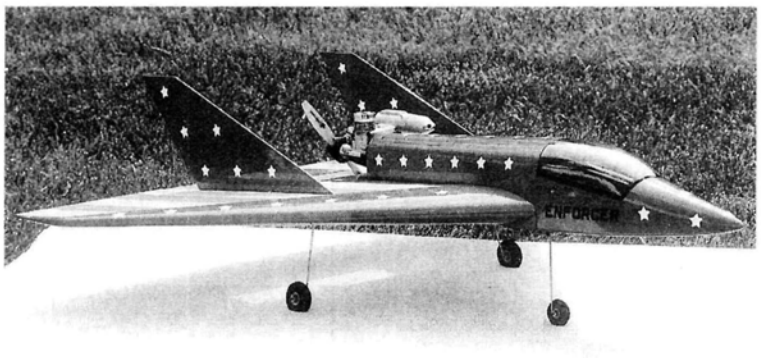
MAIDEN MODEL PRODUCTS

Snow Skis

Hand-crafted of 6061-T6 aircraft aluminum, these skis can be installed and adjusted in seconds. The 5/32-inch axle blocks have dual stainless-steel setscrews 60 degrees apart to provide a positive, non-slip grip. The axle height on the standard ski is equal to that of a 4½-inch tire and can be adjusted. The skis feature an inverted leaf spring for simple, reliable self-centering. The standard size suits models of 4 to 12 pounds; the large size suits models of 12 to 18 pounds.

Prices—$30 (standard tail-dragger), $42.50 (standard tricycle), $42.50 (large tail-dragger), plus $5 S&H.

Maiden Model Products, 3780 Northern Ave., Wayzata, MN 55391; (612) 471-8336; email: maidenusa@webtv.net.



BALSA USA

Enforcer

Laddie Mikulasko's Enforcer has always been a great flying model, and now that Balsa USA has redesigned and improved the kit, it should be even better. The kit comes with rolled, full-size plans, photo-illustrated instructions, die- and jig-cut parts, a hardware package, decals, prebent landing gear and a molded canopy. Specifications: wingspan—48.5 inches; length—54 inches; wing area—1,080 square inches; weight—6 pounds; engine recommended—.60 to .65 2-stroke or .91 to 1.20 4-stroke.

Kit no.—438; **price**—$105.95.

Balsa USA, P.O. Box 164, Marinette, WI 54143; (906) 863-6421; fax (906) 863-5878.

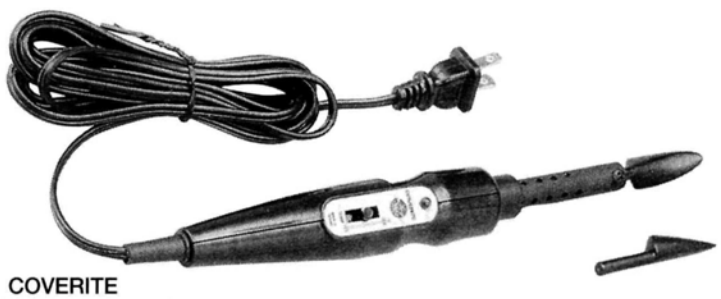
SKS VIDEO PRODUCTIONS

'98 Heli Internationals

This 120-minute video of the largest helicopter event in the world features world-record events, night flying, 3D aerobatics and scale. Featured pilots include Brazilian FAI champion Chico Brendler, Sky King Mark Fadely and Germany's Ingo Schmit. The new Imperio and Raptor machines from Japan are also shown.

Price—$24.95 (plus $3.25 S&H).

SKS Video Productions, R.D. #1, Box 264, Pine Rd., Abbottstown, PA 17301; (800) 988-6488 or (717) 259-7193; fax (717) 259-6379; email: sksvideo@cyberia.com; website: www.yorkpa.com/sks.



COVERITE

Trim Sealing Iron

A sliding temperature control allows you to set the exact temperature you need when you apply heat-shrink covering. The iron has a wide temperature range of 105 to 305 degrees F and comes with a deep, rounded tip for fillets and curves and a thin, flat, narrow tip for hinge gaps, flat areas and tight corners. These tips feature a coating that allows the shoe to smoothly glide over the covering. The iron also comes with a safety stand and a 9-foot cord.

Part no.—COVR2750; **price**—$34.99.

Coverite; distributed by Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008; website: www.coverite.com.

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MEMORY CARDS. Double the model memory of your Futaba 8UAF/H/S computer radio. Aftermarket part @ half the Tower Hobbies price!! Free S&H; send $39.95 to SM3S, 50 Estambre Rd., Santa Fe, NM 87505; SASE for more info. [6/99]

SCALE AIRCRAFT DOCUMENTATION and resource guide. Larger, updated 1999 edition. World's largest commercial collection. Over 7,400 different color Foto-Paks and 35,000 3-view line drawings. 228-page resource guide/catalog, $8; Canada, $10; foreign, $15. Bob Banka's Aircraft Documentation, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [7/99]

ALUMINUM CAN PLANS. Airplanes, racecars, ships, locomotives. LSASE for list. Tesscar, Box 333A, Scappoose, OR 97056, or http://members.aol.com/tesscar. [12/99]

ESTATE SALE—model plan collection, over 700, A-Z, primarily scale aircraft. $4 list cost is refunded with any order. Ron Noreen, P.O. Box 1554, Auburn, WA 98071. [6/99]

HOT AIR BALLOONS—build 10-foot hot air balloon easily. Plans: $5. Donald Jacobson, 104 Bailey Dr., N. Branford, CT 06471. [10/99]

MINIATURE PLUNGE ROUTER BASE AND NEW TEMPLATE GUIDE BASE. Fits Dremel, Ryobi, Foredom. "Am I impressed? You bet!"—review, *Model Airplane News*, November 1998, p. 78. Bishop Cochran, (503) 231-5694; http://www.bishopcochran.com. [10/99]

SCALE PLANS by Vern Clements, 308 Palo Alto, Caldwell, ID 83605. Send LSASE. [7/99]

R/C FLIGHT INSTRUCTION PLUS: go from beginner to instructor in one week; previous R/C flying experience not required. Using my proven "Ragland Technique" (at June '98 Grand Event). Within 7 days, I can teach you to skillfully fly R/C aircraft well enough to train others. Call or write: Clarence C. Ragland, 546 Niagara St., Lockport, NY 14094; (716) 434-7965. [8/99]

P-47 FIGHTER PILOT OFFICIAL TRAINING MANUAL: 96 pages of pictures and information about all switches, gauges, controls, etc. All you need to know about a P-47. For copy, send $15 U.S. (foreign OK). Jim Matthews, 2324 W. Hammer Ln., Stockton, CA 95209-2327. [6/99]

MINI-BOLT: standard and metric fasteners, drills, taps, dies, ball drivers, hardware. Mail-order catalog—$2. Esseltine Enterprises Ltd., 691 Fife's Bay Rd., Peterborough, Ontario, Canada K9J 6X3; phone/fax (705) 876-8645; email: suee@ptbo.igs.net. [6/99]

MAKE YOUR OWN ROCKET MOTORS!!! Homemade solid and composite fuels, power R/C gliders, model rockets, etc. Smoke tracers for R/C planes and choppers, electric igniters, cannon fuse "chemicals," lab acids. Glassware, "how to" books, videos, rocket motor kits; huge catalog $2. Pyrotek, P.O. Box 300, Sweet Valley, PA 18656; (717) 256-3087. [7/99]

PLANS ENLARGING SOFTWARE—PLANS ENLARGING: old magazines, scanning, plotting. Free information. Concept, Box 669A, Poway, CA 92074; (619) 486-2464. [7/99]

LARGE-SCALE SAILPLANES AND TOWPLANES—new and used. Call (212) 879-1634; Sailplanes Unlimited, 63 East 82nd St., New York, NY 10028; www.sail planes.com. [8/99]

PLANS—R/C sailplanes, scale, sport and electric. Old-timer nostalgia and FF scale and sport-powered, rubber and towline. All models illustrated. Catalog $2. Cirrus Aviation, P.O. Box 7093, Depot 4, Victoria, BC V9B 4Z2 Canada. [8/99]

www.coptercorner.com: a full-service R/C helicopter site since 1978. Email: helifly@best.com. [12/99]

R/C SOARING DIGEST: monthly journal for R/C soaring enthusiasts focusing on technical, construction techniques and glider design since 1984. Sample copy: $2.50. One-year subscription: $30—check payable to RCSD, P.O. Box 2108, Wylie, TX 75098, (972) 442-3910. [6/99]

HIGH-QUALITY LASER-CUT PROFILE AND SCALE KITS. For more information, send SASE to Hoemcraft Aviation, 1204 S. 4th, Independence, OR 97351; websitehttp://members.aol.com/hoemcraft/aviation.html;email:hoemcraft@aol.com. [5/99]

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MODEL WARPLANES: 10,000 plans, kits; $18. John Fredriksen, 461 Loring, Salem, MA 01970; http://www.rconline.com/1812. [7/99]

ILLNESS SALE: kits, planes, plans, engines, servos, power packs, chargers, radios and much more. Call Leon at (302) 629-4858. [5/99]

HOBBYIST

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WANTED: G-Mark .030 engine. Rudy Berg, (541) 683-8963. [5/99]

MODEL AIRPLANE NEWS, 1930-1980; "Air Trails," 1935-1952, "Young Men," 1952-1956; "American Modeler," 1957-1967; "American Aircraft Modeler," 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, B.C. Canada VOR 101. [10/99]

WANTED: built or partially built scale Cessna 150, 152 or 172. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585; fax (714) 458-6455. [10/99]

EVENTS

APRIL 18 ELK GROVE VILLAGE, IL: Chicagoland Radio Control Modelers 18th annual auction and swap meet. Al Hattendorf Center, 225 E. Elk Grove Blvd.—10 a.m. to 2 p.m.; general admission $3; vendors $12 (first table) includes one admission. Additional tables $10 each. Set up: 8:30-10:00; doors open to public 10 a.m.; auction at noon. Advance reservations accepted. Dave Crown, 9386 Landing Sq. # 507, Des Plaines, IL 60016-5270; (847) 824-6392. [5/99]

"T.O.C. OF MARYLAND." Fly-in and competition—May 21, 22, 23. Fun-packed weekend filled with fantastic flying and great food! Competitors will fly known and unknown programs with emphasis on freestyle acrobatics. $$ prizes. Raffles. Free flea-market area. Vendors welcome. Call Art Vail, (410) 247-4281, or email artvail@erols.com. [6/99]

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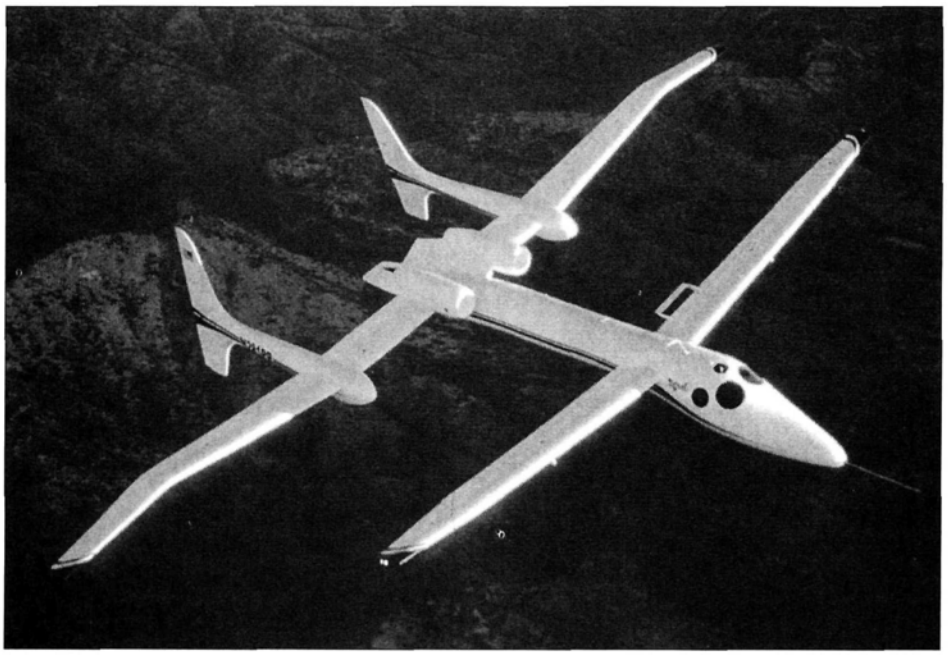
NAME THAT PLANE

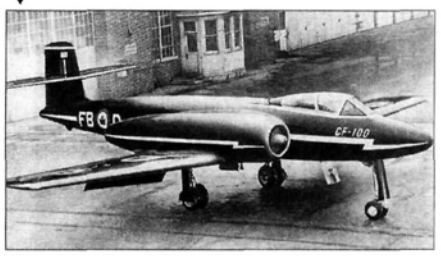
Can you identify this aircraft?

Send your answer to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606 USA.



The winner will be chosen four weeks following publication from correct answers received (delivered by U.S. mail) and will receive a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free, one-year extension of his subscription.

Reg Tunstall of Santa Paula, CA, easily identified the February 1999 mystery plane as the Avro Aircraft CF-100 because he has flown in it. Reg writes, "The prototype Avro CF-100 (tail no. 18101) was powered by two Rolls Royce engines. ... [It] crashed in 1951 while being test flown by an RCAF lieutenant and an Avro engineer, killing both people. I was employed by Avro during this period and flew in all three [CF-100] prototypes. The photo was taken outside the flight test hangar at Avro's Malton, Ontario, facility in 1951."



Index of Manufacturers

Ace Hobby Distributors, 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037; (660) 584-7121; fax (660) 584-7776.

Aeronaut; distributed by Hobby Lobby Intl. (address below).

AstroFlight Inc., 13311 Beach Ave., Marina del Rey, CA 90292; (310) 821-6242; fax (310) 822-6637; website: www.astroflight.com.

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Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742; (916) 631-8385; fax (916) 631-8386.

YNT Design, P. O. Box 66061, Fairport, NY 14450; (716) 421-0745.

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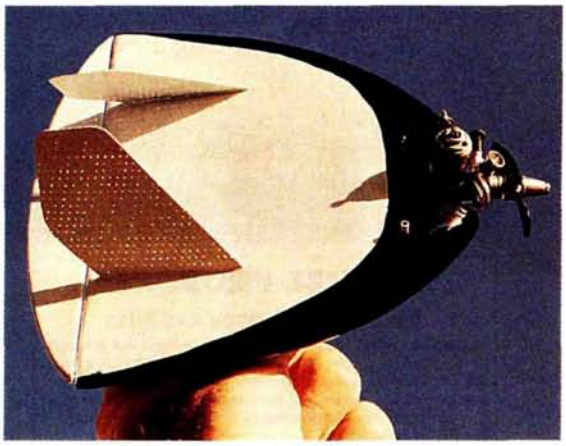
Advertisers

BY STEVE MORRIS

Trochoids are coming!

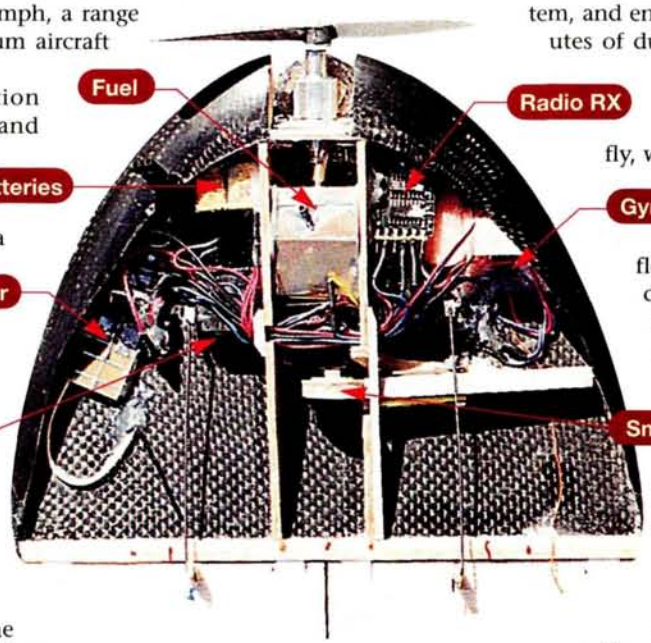
Micro air vehicles (MAVs) are intended to be the soldier's personal spy plane. Groups of these tiny aircraft would be able to perform close surveillance missions in urban settings, track chemical warfare agents, designate targets on city streets or behind windows, dispense "smart dust" nano-sensors and jam enemy radar. The Defense Advanced Research Projects Agency (DARPA) has been funding the development of these micro spies for the last three years, and my company, MLB, has been funded by DARPA since June 1998.



A 6-inch Trochoid.

I first heard of the MAV concept in the fall of 1996 and decided to see if I could use computer analysis, along with simple R/C models, to develop a family of small spy planes that could meet the military's performance requirements. These requirements include half-hour duration, the ability to cruise at 40mph, a range of at least one mile and a maximum aircraft size of 6 inches.

I wrote a computer optimization code that simulated the mission and found the smallest configurations that could do the job with a 1-ounce payload. This study taught me the importance of a large power-to-weight ratio for these short-duration, heavily loaded aircraft. I built a 6-inch-span prototype called the "Fly-swatter," a square all-wing design that was powered by a Cox .010 and flown with a 2-channel micro system. The MAV flew well but was very tricky to control. Real MAVs will use autopilot systems for stability and navigation, but the microelectronics to accomplish this are just being developed.



The University of Florida sponsored a Micro Air Vehicle competition in 1997 to encourage the development of small spy aircraft that could perform real surveillance missions. The goal was to fly 600 meters to a 1.5x1.5-meter target on the ground and capture an image of it for the judges to see. In 1997, I won the contest with a 31-inch aircraft that carried two video cameras and a video transmitter system. I won the contest in 1998 with a circular, all-wing design named the "MicroDot," whose size was a mere 14 inches.

My experience in these competitions enabled me to reduce the size of my spy planes by a factor of two; the MLB Trochoid is the latest result of this effort. The Trochoid is an all-wing design with a planform similar to a Wankel engine's piston. This shape has nearly the maximum surface area for a given size, yet has the desirable aerodynamic properties of a delta wing. The Trochoid is powered by a modified Cox Pee Wee .020 engine with a custom-built muffler and throttle. It carries a video transmitting system with a color camera, a piezo gyro stabilization system, and enough fuel and batteries for 10 minutes of duration. A special version without video has flown for over 18 minutes on a single flight. The entire aircraft weighs 7 ounces ready to fly, which gives a wing loading of about 16 ounces per square foot.

The Trochoid has amazing flight capability. It can be flown at a high angle of attack (45 degrees) that allows it to "hang" from its propeller and crawl along at 10mph. If you put the nose down and fly on the wing, you can scoot along at 60mph; just be sure to get ready for a high-G turn before it disappears from view!

I have also flown a 6-inch Trochoid with a gyro stabilization system, but no video equipment. This version is powered by a Cox TD .010 with muffler and throttle. It is very hard to see in the air and must be kept close by to avoid losing it.

MLB is currently working on an autopilot system for the 8-inch Trochoid with the hopes of flying some long-range missions in the next three months. Our development of these vehicles is progressing rapidly, so it's hard to predict where we'll be in a year; but it's certain that the notion of tiny operational aircraft is possible within the next few years.

Eight-inch Trochoids. Left photo shows the aft-facing black and white camera.